

A PHILOSOPHICAL EXAMINATION OF ARISTOTLE'S *HISTORIA ANIMALIUM*

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University of Pittsburgh, 2014

In this dissertation I address two related questions pertaining to Aristotle's philosophy of science and his biology and zoology. They are: (1) what are the goals of Aristotle's *Historia Animalium* (*HA*) and how does the treatise achieve these goals? And, more generally, (2) what is the role of a *historia* in Aristotle's philosophy of science? Together these questions touch upon a long recognized problem in the interpretation of Aristotle's philosophical and scientific works related to the relationship between Aristotle's philosophy of science and his actual scientific practice. I pursue this broad question by focusing my attention on Aristotle's *historia* of animals and the related discussions of scientific investigation and demonstration, primarily in the *Analytics*. I argue that the term *historia* was used by Aristotle with a range of meanings that center around the notions of *investigation* and *inquiry* (or the reports thereof), and, in some instances, emphasize the early stages of inquiry, dedicated to establishing and organizing facts prior to causal explanation. I proceed by considering the theoretical background of a *historia* provided by the *Analytics* and *Parts of Animals*, before turning to a detailed analysis of select passages from the *HA* itself. I argue that the *Analytics* provides the framework for a method of correlating facts regarding a field of study that acts as a guide to further causal research, but that establishing the actual causal relations that hold within a field depends upon additional considerations that are largely domain-specific. I turn to the *HA* in order to illustrate this method of correlation, noting examples where the correlation of features appears to prefigure causal

explanations. I conclude by considering the relationship between Aristotle's notions of *historia* and experience (*empeiria*), and argue that a *historia* provides the sort of comprehensive, factual knowledge of a domain of study that Aristotle often notes is necessary for coming to recognize causal relations, and thus coming to have scientific knowledge (*epistêmê*).

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PREFACE

The Greek text for the many quotations in this dissertation was taken from the Thesaurus Linguae Graecae (TLG). Their web site may be consulted for the details regarding the exact editions used. The important exception is the text used for passages from the *Historia Animalium*, which were copied from TLG but checked against Balme's 2002 text.

Like many dissertation, but perhaps more so than most, this project was long in the making. For their help in researching and writing this dissertation, and in general for their support and encouragement, I would like to thank the following people: Kathleen Cook, Jessica Gelber, Christopher Kurfess, Mariska Leunissen, Patrick MacFarlane, and Ron Polansky. Special thanks goes to my advisor, Jim Lennox, for his detailed comments and high standard of scholarship, and to the other members of my committee: James Allen, Jim Bogen, Alan Code, and Peter Machamer. In addition I would like to acknowledge Allan Gotthelf, who provided the initial inspiration for this project, and who unfortunately did not live to see the dissertation through to completion.

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INTRODUCTION

Aristotle's *History of Animals* has variously been interpreted as a disorganized, loosely connected collection of facts about the animal world, whose purpose is to provide something like the “raw material” from which a demonstrative science of animal life may be constructed; to a highly organized and structured treatise that deeply reflects the prescriptions on demonstration and inquiry espoused elsewhere in the corpus, and especially in the *Analytics*. At a minimum, there is agreement that the treatise does report a host of purported facts about animals and the features they exhibit, but what principles structure the presentation of those facts, and the precise purpose of their collection, remains debated.

The issue is challenging because Aristotle says little explicitly within the *HA* itself regarding its purpose and methodology. This is rather unusual, as many Aristotelian treatises begin with fairly lengthy discussions that place the subject matter under consideration into some sort of investigative context, and often include extended considerations of the methodology appropriate to the area of study.¹ What is said in the *HA* in this regard, as we shall see, is open to a fair amount of interpretation. However, Aristotle's use of the term *historia* in a number of presumed references to the treatise (as well as in the traditional “title” itself) provides a possible

¹ E.g. *Phys.* I.1, *PA* I, *Meteo.* I.1, *EN* I, *An.* I.1. See Lennox 2011, pp. 28ff.

link to the theory of inquiry and demonstration put forth in the *Analytics*.² Indeed, some have argued that a fairly coherent picture of what a *historia* is and its role in scientific investigation and explanation may be constructed based on various methodological discussions within the corpus. However, these very methodological discussions, and especially those of the *Analytics*, have proven just as difficult to interpret as the *HA* itself, and disagreement regarding the interpretation of these passages has carried over to the interpretation of the *historia* of animals that is the *HA*.³

Further complicating the matter is the fact that no other similar *historia* is preserved in the corpus, or even referred to in the ancient lists of Aristotelian writings.⁴ Why this should be—why a *historia* of animals was composed and preserved as a separate treatise, but no other *historia*—is a question yet to find an adequate answer, and makes the task of interpreting the *HA* the more difficult, as we have no other examples to turn to.

In this dissertation I seek to address two related questions pertaining to what we might call Aristotle's philosophy of science and his biology/zoology. They are:

² The extent to which the *Analytics* considers methodological questions regarding the manner in which an investigation should be conducted, and the reasons why, as opposed to the manner in which knowledge should be exhibited or formalized, is debated in the literature.

³ See especially the discussions of Lennox and Charles below.

⁴ However, there are stretches of text in some treatises that report information in a manner arguably similar to that found in the *HA*, e.g. *Meteor.* III.2 on rainbows and haloes : "Regarding halos and rainbows, both what each is and because of what cause they come to be, we must speak, and mock suns and rods too. For all these things come to be because of the same causes. But first we must grasp the affections and attributes (*ta pathê kai ta sumbainonta*) regarding each of them" (371b18-23). See Freeland 1990. Also Theophrastus famously composed his own *historia* on plants. On the relationship between Aristotle's and Theophrastus' *historiai*, see Gotthelf 1988.

(1) What are the goals of Aristotle's *History of Animals* and how does the treatise achieve these goals?

(2) What is the role of a *historia* in Aristotle's philosophy of science?

Together these questions touch upon a long recognized problem in the interpretation of Aristotle's philosophical and scientific works, namely, what is the relationship between Aristotle's philosophy of science, as it is discussed in works such as the *Prior* and *Posterior Analytics*, and his actual scientific practice, as it is exhibited in the treatises dedicated to natural philosophy? I shall pursue this broad question by focusing my attention on Aristotle's *historia* of animals, the *HA*, and the related discussions of scientific investigation and demonstration, primarily in the *Analytics*. My goals are to provide a critical reading of existing interpretations of the role a *historia* is designed to play; to analyze Aristotle's own comments, in the *Analytics* and elsewhere, regarding the stages of scientific investigation and, in particular, the character of the early stages; and to provide a close reading of select portions of the *HA* itself in support of my understanding of what a *historia* is and what its relationship is to the ultimate goal of scientific investigation.

In chapter 1 I provide a survey of the relevant prior literature on the interpretations of *HA* and its relationship with the theory of demonstration and inquiry presented in the *Analytics*. The focus is on the line of interpretation initiated by David Balme, and carried forward by James Lennox and Allan Gotthelf, I then turn to comments made by David Charles regarding the role of *historia* in Aristotelian natural philosophy, and how Charles's view differs from those of Balme, Lennox, and Gotthelf.

In chapter 2 I examine the various uses of the term *historia* in the Aristotelian corpus, focusing on two major groups: (1) passages that use the term in a general way, and (2) passages that use the term in what appear to be direct references to the *HA*. I argue that though the term *historia* is used by Aristotle with a range of meanings, these meanings are related, and point to a “technical” use of the term that refers to an early stage of research dedicated to collecting and organizing data prior to causal explanation, and that this technical use is the one intended in the title of *HA*.

In chapter 3 I discuss the theoretical background to the concept of *historia* provided by the *Analytics* and the first book of *Parts of Animals*. The focus of the discussion of the *Analytics* is on the distinction Aristotle draws between knowing the fact (*to hoti*) and knowing the reason why (*to dioti*), and how the *hoti*-stage of investigation can facilitate the move to the *dioti*. This leads to a consideration of Aristotle’s method of correlation introduced in the second book of the *Analytics*, and the various ways that correlation can be used to guide causal research, even if it cannot, alone, reveal causal priority. This in turn leads to a consideration of *PA I*, where Aristotle discusses the kind of causality that takes precedence in nature, and thus points the way towards arranging correlated features according to cause and effect relationships.

The first six chapters of the first book of *HA* form something of an introduction to the entire treatise. Aristotle describes the stretch of text as a “sketch” or “outline” (*tupos*) that is designed to provide a “taste” of what will be discussed with greater precision later. This suggests that a proper understanding of exactly what is accomplished in this stretch of text will shed light on the rest of the treatise. In chapter 4 I provide a detailed analysis of this *tupos*. I argue that in it Aristotle provides an introduction that both outlines the rest of the treatise, and provides a more

theoretical discussion of concepts and points of method that will play crucial roles in what follows.

In chapter 5 I analyze a number of select passages from the body of the *HA*, and compare them with the picture of a *historia* developed thus far. The chapter begins with an extended consideration of why the *HA* begins with a study of the parts of animals (rather than e.g. their activities, manners of life, or characters), and why this discussion begins with the parts of humans. This leads to a reflection on Aristotle's comment that a goal of the *historia* of the parts of animals is to provide the *logos* of the parts in addition to the perception of them. I then turn to an extended analysis of the structure of the discussion of the parts of animals in *HA*, followed by a consideration of passages that appear in each of the remaining major sections of the treatise, dedicated, respectively, to generation and reproduction, other activities and manners of life, and the characters of animals.

Finally, in chapter 6 I consider the relationship between Aristotle's notions of *historia* and experience (*empeiria*). I argue that in addition to the sense of *empeiria* as a sort of cognitive middle ground between perception and knowledge, as developed in passages found in *Metaph.* A.1 and *APo.* II.19, Aristotle also used the term to connote a broad and comprehensive knowledge of the facts pertaining to a field of investigation. This sense of *empeiria* corresponds well to the stated goals of a *historia*. I then consider how this second sense of *empeiria*, and thus how a *historia*, may facilitate the discovery of causal knowledge.

1.0 PROBLEMS AND PRIOR LITERATURE

1.1 INTERPRETATIONS OF *HA*

In reviewing the various claims regarding the purpose and method of the *HA* it is useful to organize the discussion around two main camps of modern interpretation. On the one hand we have a line of interpretation originating in the work of David Balme, and continuing with the work of Allan Gotthelf and James Lennox; and on the other hand we may take the detailed and difficult discussion of *HA* and its aims in David Charles's book *Aristotle on Meaning and Essence*. In what follows, I begin with a consideration of some modern commentators on *HA* prior to Balme, and then continue by developing the views of Balme, Gotthelf, and Lennox. I shall then present a summary of David Charles's discussion of *HA* and its goals/methods, and conclude with a reflection on the problems and puzzles that remain.

1.1.1 Prior to Balme (Louis, Peck)

Prior to Balme's work we do not find great scholarly interest in *HA*,⁵ at least from a philosophical point of view, and its contents were often viewed as a disorganized mess of information, perhaps groping towards a taxonomic classification of animal kinds, but failing in this regard badly.⁶ In the introduction to his 1964 French edition of *HA*, Pierre Louis defends the organization of *HA* from such criticism, and rightly points out that much confusion is caused by the chapter divisions, which were late, Renaissance-era additions that often interrupt or obscure the flow of discussion and argumentation.⁷ According to Louis, the organization of the treatise is more easily grasped by following Aristotle's own remarks near the beginnings and ends of various discussions, in which he indicates what was previously discussed and what is to be discussed moving forward.⁸

Louis understands the *HA* to be a treatise dedicated to collecting facts regarding the animal world that are to be explained later in treatises such as *PA* and *GA*. He holds that *HA* was "undoubtedly" composed prior to these other explanatory works,⁹ and that the *HA* is a

⁵ This is especially true of the English-speaking world. Scholars on the continent exhibited greater interest in Aristotle's biological works dating back to the 18th and 19th centuries. See Gotthelf 2012b, p. 263 n.5 for French, German, and more recent Italian references.

⁶ See Balme 1987b, pp. 80-5; Gotthelf 1988, pp. 309-10.

⁷ See Beullens and Gotthelf 2007, pp. 477-483.

⁸ See Louis 1964, pp. xx-xxii for references to such "sign posts" in the treatise.

⁹ Louis 1964, pp. xiv-xviii. As evidence, Louis cites both the apparent "logical" relationship between a *historia* and the explanations it facilitates (i.e. first establish facts, then search for explanations), as well as the apparent references to *HA* in the other biological treatises, many of which refer to the *HA* in the past tense, as a treatise already completed. Louis does not seem to seriously consider the possibility that the references to *HA* in *PA* and *GA* may be relatively late insertions (either by Aristotle or someone else), and that the verb tense of the textual reference may reflect something other than the chronology of composition (e.g. may indicate a didactic chronology).

representative (perhaps the sole existing representative¹⁰) of a kind of treatise designed to report on an early stage of investigation, focused only on collecting facts without regard to possible explanations, and destined to be replaced by more complete, explanatory accounts of the same material.¹¹ In this regard, Louis is clearly influenced by Aristotle's own comments, in *HA* I.6, *PA* II.1, *IA* 1, etc., that the *historia* is designed to precede causal explanation, but Louis does not elaborate on how, or indeed whether, the *HA* actually *facilitates* the discovery of such explanations. In fact, Louis seems to banish any consideration whatsoever of causes or

¹⁰ Louis argues that the Aristotelian corpus may be divided into two main categories: (1) philosophical dialogues written for a wide audience, and (2) scientific treatises, written for a much narrower audience of specialists. As only fragmentary evidence of Aristotle's dialogues has survived, the corpus as we have it today is comprised solely of this second category. Louis further divides the scientific treatises into two categories: (2a) didactic treatises dedicated to a particular problem or set of problems, written to be reproduced for students, and composed with an aim of giving explanations of established facts, and (2b) treatises dedicated to recording, classifying, and establishing these facts ("*les classer*"). This second category of scientific treatise, into which, according to Louis, *HA* falls, provided the basis for the didactic treatises: "Ce sont des collections de faits, des recueils de remarques et d'observations, destines a fournir la matière des traites didactiques. Telle est l'*Histoire des Animaux*" (Louis 1964, p. xii).

¹¹ As evidence, Louis provides a number of examples of passages in *PA* and *GA* that have corresponding passages in *HA*, with the difference that the former include explanations of the phenomena discussed, while the latter do not (specifically he cites: *GA* III.1, 749b28 and *HA* IV.1 558b15; *PA* III.4, 666b23-35 and *HA* I.17, 496a4-27). This suggests to Louis that the *HA* passages, lacking explanatory content, were replaced by the *PA* and *GA* passages. Based on a comparison of such passages, Balme came to a different conclusion, namely that the *HA* was likely composed *after* *PA* and *GA*, and that in composing the *HA* Aristotle likely began by culling relevant information from these treatises, then added to it. See Balme 1991, pp. 21-6. Lennox 1996, a critical assessment of "The Balme Hypothesis," agrees with Balme's dating the *HA* after these other biological treatises, though he remains skeptical that an absolute dating of the biological treatises may be determined. In addition Louis notes the absence of *HA* from the programmatic statements that Aristotle periodically appends to the beginning or end of treatises, stating the order in which study of the natural world or living things should proceed. He argues that this indicates that *HA* was not intended to be a part of such a program of study, but rather was meant to furnish the other treatises with the material necessary for their work. In other words, once these other treatises were written, *HA* (or at least the relevant portions of *HA*) was no longer needed.

explanation from *HA*.¹² Whether he saw the project of the *HA* in any way related to the discussions of demonstration and inquiry in the *Analytics* is unclear since he makes no mention of this. Thus according to Louis *HA* was to furnish the material for works like *PA* in only the most rudimentary of ways, providing facts in need of explanation, and perhaps also facts that could themselves serve as explanations, but with no attention to distinguishing or relating the two. He offers no detailed account of the complicated arrangement of data in the treatise, nor does he speak to the manner in which the data was presumably culled from observations.

In the introduction to the first volume of his 1965 Loeb *HA*, Peck, like Louis, argues that the aim of *HA* is not taxonomy or classification of animal kinds, but rather the collection of facts regarding animals. More specifically, Peck emphasizes that *HA*'s primary interest is in collecting information regarding the different attributes exhibited by animals prior to searching for their causes. Quoting Balme's 1961 paper "Aristotle's use of division and differentiae,"¹³ Peck states that the error underlying the mistaken view that *HA* is primarily concerned with taxonomy is the assumption that Aristotle "put systematics first in zoology, and morphology first in systematics."¹⁴ That is, it is an error to think that Aristotle holds that (1) explaining zoological phenomena requires the construction of a systematic taxonomy of animal kinds, and that (2) the construction of such a system must be based on the parts of animals. Peck concedes that Aristotle does introduce a basic classification of animal kinds into *megista genê*, but he states "the purpose

¹² "L'auteur (i.e. Aristotle) ne s'est préoccupé que de recueillir le plus grand nombre possible d'observations. Il ne s'est pas soulié, quand il l'a rédigé, d'expliquer les phénomènes dont il faisait ni d'en rechercher les causes" (Louis 1975, p. 80).

¹³ Reprinted, in expanded form, in 1975 and finally as Balme 1987.

¹⁴ Quoted in Peck 1965, vi.

of this is not to provide a starting point for systematic division and subdivision; it is for convenience in reviewing the various observable differences.”¹⁵

Instead of taxonomy or classification, Peck holds that the aim of the *HA* is “to collect data for ascertaining the causes of the observed phenomena.”¹⁶ As Peck writes:

Until we have got the *historia*, we are not in a position to see what we are dealing with, or how to deal with it. Once we have got it, we can go on to the second stage, which is to attempt to find out the “causes” of these observed and recorded differences.¹⁷

That is, a comprehensive view of the actual differences exhibited by animals (i.e. features/attributes that differ among different kinds/forms of animals) will facilitate the discovery of the causes of those differences by making clear “what we are dealing with” and “how to deal with it.” More specifically, Peck claims that the *historia* brings to light correlations between features that may act as “clues” to causal explanation: causes will be found “by looking to see whether certain characteristics are regularly found in combination: this is how the clues to the causes will be brought to light.”¹⁸ Peck gives no examples or arguments to support his case, and does not explicitly connect this method of searching for causes with any of the discussions of demonstration or inquiry in the *Analytics*. In fact, it’s not clear whether Peck attributes the aim of identifying correlations to the *HA* itself, or whether he thinks that the *HA* simply prepares the researcher to find them.

¹⁵ Peck 1965, vii.

¹⁶ Peck 1965, vi.

¹⁷ Peck 1965, v.

¹⁸ Peck 1965, vi.

Although Peck agrees with Louis that the focus of *HA* is not on the classification of animal kinds, he nonetheless appears to think that classification is an ultimate aim of the project for which *HA* is the preliminary stage:

If we are right in supposing that the purpose of the treatise is preliminary, viz., to collect together as many records of differentiae as possible as a basis for discovering the causes of observed phenomena in animals, then it constitutes an earlier stage of the whole process than classification, to which it will be a prelude.” (xi)

According to Peck, the project of discovering the causes of the attributes of animals will lead to a satisfactory classificatory scheme by identifying the single cause (or few causes) most responsible for determining the character of animal kinds. Peck takes natural heat (*sumphuton thermon*), and what according to Aristotle is its most observable indicator, mode of reproduction (i.e. live-bearing, egg-bearing, etc.), as offering the true classificatory principle for Aristotle’s biology.¹⁹ But following a long discussion of the ways in which natural heat operates to determine the characteristics of animals, Peck concedes that Aristotle would probably not have claimed that such a classification based on natural heat could be made “wholly tidy,”²⁰ by which I take it he means that it would not produce a perfectly comprehensive and mutually exclusive taxonomy of all animal kinds, leading from the highest, most general kinds to the *infimae species*, and passing through a number of sub-genera in between. Rather, it provides a basic

¹⁹ This is the same criterion Lloyd puts forward in his 1961 *Phronesis* article as Aristotle’s most mature view on animal classification. See Gotthelf 2012b, p. 267 for a rejection of this view, with which I largely agree.

²⁰ Peck 1965, xxxi.

classification that captures the true cause of variation between kinds of animals, namely, level of “perfection,” which is correlated with degree of natural heat and, further, mode of reproduction. He does not specify whether the *megista genê*, or “very large kinds” discussed by Aristotle in *HA* I.6 and elsewhere, embody this basic classification.

It is odd that Peck rejects classification as a significant aim of *HA*, and yet spends the majority of his introduction to discussing this very topic. He was clearly influenced by his work on the Loeb *GA* (first published in 1942) and the important role played there by natural heat and the “movements” resident in the generative residues, and he seems to take the introduction to his translation of the *HA* as an opportunity to work out his views on classification in Aristotle’s biology and the role of vital heat. Regarding his “positive” views on the *HA*, we are told little other than (1) it is primarily a “factual” treatise, (2) its focus is on the differentiae exhibited by animals, and (3) it is meant to precede a search for the causes of the differentiae. His suggestion that significant combinations of differentiae will provide “clues” regarding their underlying causes is left undeveloped, and he provides no real insight into the manner in which the data presented in the *HA* are handled. He notes that the *megista genê* are introduced “for convenience” in examining the observed attributes of animals, but provides no explicit guidance regarding how that might work.

1.1.2 Balme

David Balme lays out what continues to be the most influential interpretation of the aims and methodology of the *HA*.²¹ Following Aristotle's own statement on the aims of the treatise (at 491a7ff.), Balme states that the work's primary aim is to grasp the differentiae (*diaphorai*) and attributes (*sumbebêkota*) that belong to all animals.²² Though he notes that these are technical terms derived from the practice of division (*diaeresis*), Balme claims that in the *HA* these distinctions, as well as that of an attribute holding in itself (*kath'hauto*) and not in itself (*mê kath'hauto*), disappear, and all attributes are treated on an equal footing:

In *HA* . . . no use is made of distinctions between differentiae and attributes nor between proper and accidental (i.e. *kath'hauto* and *mê kath'hauto*): all characteristics are examined on the same footing and are called differentiae or attributes indifferently—if there is a difference it exists only in their basic sense . . . but not in their full technical sense. The reason is that presumably the technical distinctions have meaning only in relation to the defining of whole objects, whereas *HA* does not study animals as wholes but only their separate characteristics.²³

That is, a feature can serve as a differentia only relative to a given *genos* (i.e. the technical use of a differentia is to divide a *genos* into *eidê*). Similarly, a feature holds *kath'hauto* or *mê kath'hauto* only relative to a given *eidos*. Considered on their own, apart from the *genê* or *eidê* of

²¹ See also Gotthelf 1988, pp. 309-12, and 2012b, pp. 263-75 for excellent summaries of Balme's views on *HA*.

²² Balme 1987a, p. 11; 1991, p. 13.

²³ Balme 1991, pp. 14-5.

the animals that exhibit the features, these distinctions have no meaning, and thus, according to Balme, are not used in the *HA*. Balme maintains that the focus of the treatise is not on animals considered as “wholes,” but rather on the attributes exhibited by animals. He describes the aim of the treatise as “to collect, screen, distinguish, and describe correctly the differentiae requiring explanation.”²⁴ It is both a “collection” and an “analysis” of the differences between animals,²⁵ and thus the treatise has a “theoretical” purpose. The attributes themselves are analyzed at varying levels of generality, from the very high, generic level of blooded and bloodless, to “sub-specific” features and “variable accidents” that are unique to certain individuals.

Balme takes the ultimate aim of collecting and organizing these features to be causal explanation. However he emphasizes that what is to be explained are the features/attributes that are collected and analyzed. That is to say, the focus on attributes carries over to the explanatory project that is to follow *HA*, and thus the question of animal kinds and a classification of animals is not raised.²⁶ Balme notes the close connection that, for Aristotle, causal explanation has with

²⁴ Balme 1987b, p. 80.

²⁵ Balme 1987b, p. 88.

²⁶ This is important when we consider exactly what sort of facts are collected at the *hoti* stage of investigation. One very plausible possibility is that the facts collected are propositions of the form *AaB*, where *A* refers to an animal kind (species, etc.) and *B* refers to a characteristic/feature. So understood the fact to be explained is, Why *AaB*? However, on Balme’s reading, the focus is not on which animal kinds exhibit which features, but rather on the variety of features present in the animal world. This de-emphasis of animal kinds brings into question the role of the *historia* as providing *hoti*-level facts. I think Balme is wrong to say that Aristotle is not concerned with identifying which animals exhibit the features discussed in the treatise, but I agree with him that it is not always a primary aim. Often a given attribute is said to belong to “some” of a given group of animals (typically with a *ta men . . . ta de* construction), without any further indication of precisely which members of the group do so, but just as often Aristotle does provide additional criterion for picking out the animals within a group that possess the feature (typically with a second attribute, using the *hosa . . . panta* construction). In these cases I very much doubt that Aristotle is identifying a specific kind of animal with this second feature (especially if one understands by “kind” some ontologically preferred mode of classification).

definition, in so far as a definition (or at least one form of definition) is a causally explanatory demonstration with its terms rearranged, but again *what is defined* in this context is *the attribute*, and not the animal possessing the attribute.²⁷

But how, according to Balme, does Aristotle actually go about finding such causal explanations? That is, borrowing from the title of Balme's 1961 article, how does Aristotle *use* the *differentiae* collected and described in *HA* to find causes? Balme's answer is that he looks for "significant, causal groupings of *differentiae* . . . as offering a clue to the problem under discussion."²⁸ "His method is in fact what he briefly describes at *APo.* II 98a14-19: by looking for those characteristics which are regularly associated we may detect their cause."²⁹ Balme's claim is that, in the explanatory treatises like *PA* and *GA*, Aristotle looks for the solution to a problem at hand (e.g. Why does this kind of animal possess feature X?)³⁰ by examining the features that are correlated to the problem in order to try to determine a common or underlying cause. For example, in determining why certain animals have an epiglottis while others do not,

²⁷ However, if it is the case that what explains the presence of an attribute must itself be an essential feature of the animal, then causal explanations of features will also reveal essential attributes of animal kinds.

²⁸ Balme 1987b, p. 86.

²⁹ Balme 1987b, p. 86. The use of the term "clue" here makes me suspect that this is what Peck has in mind . . .

³⁰ As will be discussed in greater detail below, the exact form of the "problems" Aristotle seeks to solve in the explanatory treatises needs to be made more precise. The parenthetical formulation I provide here suggests that the problem consists of a characteristic or attribute predicated of a *kind* of animal, i.e. the subject role is played by an animal kind, such as bird, hawk, etc. However, it is often the case that the subject role in such problems is quantified by an expression similar to "all animals that possess/exhibit feature X," such that the quantifying expression does not appear to pick out a definite *kind* of animal, but rather a group of animals sharing an attribute. The distinction begins to break down if one regards *kinds* or *forms* of animals as simply *differentiae-groups*, i.e. groups of animals with select shared features. Most discussions of *kinds* in Aristotle (such as the discussions in Charles 2000) do so interpret them, but confer greater significance to certain attributes over others, as being the true *differentiae*, i.e. the attributes that correctly divide a higher kind into lower forms.

Aristotle looks for the other features animals with an epiglottis share, and the features that animals without an epiglottis share. At *PA* III.3 664b22 Aristotle states that those animals that have lungs and are hairy have an epiglottis, while those that have scales or feathers do not. What does this suggest? Animals that have scales or feathers have drier flesh and harder skin compared with hairy animals, such that an epiglottis in them would not be able to move easily enough to serve its purpose.³¹

The *APo.* passage Balme cites reads:

At present we speak in terms of the common names which have been handed down to us. But we should inquire not only in these cases, but also if any other common feature has been observed to hold, we should extract it and then inquire what it follows and what follows it. For example having a third stomach follows having horns, as does being without both rows of teeth. And again having horns follows something. For it is clear why the feature mentioned will belong to them, for it will hold because they have horns.³²

Νῦν μὲν οὖν κατὰ τὰ παραδεδομένα κοινὰ ὀνόματα
λέγομεν, δεῖ δὲ μὴ μόνον ἐπὶ τούτων σκοπεῖν, ἀλλὰ καὶ
98a15 ἂν ἄλλο τι ὁφθῇ ὑπάρχον κοινόν, ἐκλαμβάνοντα, εἴτα τίσι
τοῦτ' ἀκολουθεῖ καὶ ποῖα τούτῳ ἔπεται, οἷον τοῖς κέρατα
ἔχουσι τὸ ἔχειν ἐχίνον, τὸ μὴ ἀμφώδοντ' εἶναι· πάλιν τὸ

³¹ Cf. *PA* III.3 664b20-665a5.

³² Translation modified from Lennox 1987a and Barnes 1993.

κέρατ' ἔχειν τίσιν ἔπεται. δῆλον γὰρ διὰ τί ἐκείνοις ὑπάρ-
ξει τὸ εἰρημένον· διὰ γὰρ τὸ κέρατ' ἔχειν ὑπάρξει.

The example in the passage states that having a third stomach and not having both rows of teeth “follows” having horns, or in other words, all animals that have horns also have a third stomach and lack both rows of teeth. Aristotle next asks: from what feature does having horns follow? If we call that feature “X”, then he states it will be clear from this why all animals that possess feature X will also have a third stomach and lack both rows of teeth, namely because all such animals have horns. The procedure recommended is to find “common features” i.e. features that are always correlated with a given feature under study, and to attempt to arrange them in such a manner as to show “what it follows and what follows it.”³³

However Balme does not appear to attribute this aim (viz. identifying correlations between features) to the *HA* itself (the examples he provides in his discussion of this aim all come from other treatises).³⁴ Rather this is the procedure for finding causes that is to come after the *HA*. According to Balme, the *HA* makes it possible by providing the necessary factual information regarding the differentiae, but since the relevant correlations will vary based on the problem under consideration, the *HA* is not primarily concerned with such correlations.

The ultimate aim that the causal explanation of animal features is to serve, according to Balme, is the definition of “this visible animal,” i.e. the definition of the concrete particular animal. In this regard, Balme sketches out an interpretation of the metaphysical difficulties

³³ The example seems to assume that the “follows/followed by” relation tracks causal priority, but this is not clear. See my ch. 3, section 3.2.5, below.

³⁴ All the examples Balme gives to illustrate this method come from *PA*. See Balme 1987b, pp. 86-7.

regarding the form and essence of an animal that Aristotle wrestles with in the central books of the *Metaphysics*, according to which Aristotle's mature view is that the form of a given animal is particular to that numerically specific animal, and includes both "essential" and "non-essential" attributes.³⁵ The fusion of matter and form in the living thing allows for the "formalization" of material aspects of the living thing's nature, and thus allows for what would typically be considered non-formal attributes to be included in the animal's form. Essence is a generalization over particular animals that share certain common features in their form. The ultimate explanatory project Balme sees Aristotle as envisioning is one where *all* the features exhibited by an animal are explained—from shared features to "sub-specific" ones due to things like variations in environmental climate, disease, etc. In describing the method Aristotle would have followed, Balme states: "it is likely that he would have wanted to pick out the significant generic combinations (of attributes) and to show the specific differentiae as flowing from them."³⁶ In other words, beginning with the visible, individual animal, Aristotle would enumerate all the attributes exhibited by the animal, indicate which of them are "particularizations" of some more general kind of attribute, and look for the causally relevant features that determine the specific particularizations.

But why don't we actually find such animal definitions, in *HA* or elsewhere? Balme conjectures that Aristotle may ultimately have realized that arriving at a complete definition of an animal was an impossible task, "for there is no end to the recognition of fresh significant attributes".³⁷ Rather, Balme seems to have envisioned *HA* as an investigation into *all* animal differentiae that is intended to precede this more grand explanatory project that was apparently

³⁵ See Balme 1990 ("Matter in the Definition: a Reply to G. E. R. Lloyd").

³⁶ Balme 1987, p. 89.

³⁷ Balme 1987b, p. 80.

never completed.³⁸ In some of his last writings, Balme tepidly conjectures that, just as the project of *classification* of animal kinds may have come to be seen by Aristotle as an unnecessary and perhaps impossible task, so too the notion of *definition* may have fallen by the wayside, at least in the biology.

But if I had the courage . . . I should be tempted to say that definition and its associated logical apparatus became irrelevant to Aristotle as it has done to modern philosophers of nature.³⁹

In any event, as regards the *HA*, Balme's final view seems to have been that the *HA* is a collection and analysis of the attributes exhibited by animals, one that does not distinguish between features that are *per se*, incidental, etc., and one whose goal is to facilitate the identification of correlations between features at varying levels of generality, in the service of discovering causal explanations of the features. Balme explicitly links this method of discovering causal explanations to the *Analytics*, but apart from noting one supporting text, he does not develop the notion in any significant way.

1.1.3 Lennox and Gotthelf

While it is not clear to me that Balme saw the project of identifying important groupings of differentiae as an important aim of the *HA*, rather than as the first step in the search for causal explanation that is to follow the *HA*, the idea was developed with greater sophistication by

³⁸ Balme 1987b, p. 88.

³⁹ Balme 1990, p. 54.

Gotthelf and Lennox. They argue that identifying such correlations *is* a prominent feature of the *HA*. In a number of papers⁴⁰ based on research conducted both separately and together, Gotthelf and Lennox have spelled out the importance of establishing these correlations and the role they play in facilitating causal explanation; and also, importantly, have demonstrated that a concern with establishing such correlations does form an important aim of *HA*. In doing so they have stressed the close relationship between the discussions in the *HA* and the *Analytics* model of explanation and investigation. Both Gotthelf and Lennox have consistently maintained that there is much in the *Analytics* that shaped the investigations presented in the biological corpus, including the *HA*.

In his 1987 and 1991 papers, reporting on research conducted in collaboration with Gotthelf, Lennox shows, first, that Aristotle recognized, in the *Analytics* and elsewhere, a pre-causal, pre-explanatory (yet still theoretical) stage of investigation, and, second, that he was inclined to call such an investigation a *historia*. This being the case, Lennox suggests that one might find clues elsewhere in the corpus, and especially in the *Analytics*, on how to interpret the *historia* reported in *HA*. He goes on to demonstrate⁴¹ that there is a persistent concern in *HA* with identifying “widest class” correlations of features, and that this concern is motivated by the distinction between sophisticated and unqualified knowledge discussed in *APo*. Lennox plausibly argues that the concern with finding the widest class at which given features are correlated is grounded in the attempt to find the right level of generality at which an explanation should be sought. By connecting the discussion in *APo*. with what they demonstrate to be a clear concern

⁴⁰ See for example Lennox 1987a, 1991; and Gotthelf 1988.

⁴¹ As does Gotthelf in his 1988.

with finding such correlations in *HA*, Lennox and Gotthelf are able to make sense of many passages in *HA* that otherwise would be quite puzzling.

In his 1991, Lennox discusses a procedure for using “divisions” described in *APo.* II.14 to facilitate the identification of the correct level of generality at which a given attribute holds of a subject.⁴² According to Lennox, this procedure involves taking a preexistent set of divisions and identifying those features that belong universally to the forms that fall under each division. For instance, using Lennox’s example, if peregrine falcons are being studied, one should consult a set of divisions that include peregrine falcons, presumably as a lower level form in a branching kind-form tree of divisions. Such a set of divisions may look like: animal, bird, crook-taloned-bird, and peregrine falcon. Next locate the attribute possessed by peregrine falcons under consideration, e.g. a hooked-beak, as belonging to one of the levels of division on the tree. In this case, some, but not all, animals possess hooked-beaks, and some, but not all birds do too, while all crook-taloned birds have hooked beaks, as do all the forms that fall under crook-taloned. Thus hooked-beaks belong primitively to crook-taloned birds, and peregrine falcons have hooked beaks *because* they are crook-taloned.⁴³

Lennox calls such explanations that amount to identifying the wider kind to which a feature belongs primitively as “A-type” explanations. These are to be followed by “B-type” explanations that identify the essential feature of the wider kind that is responsible for (i.e. the cause of) the presence of the given attribute under study. Why do peregrine falcons possess

⁴² Lennox 1991, pp. 47-50.

⁴³ In fact it must be “all AND ONLY crook-taloned birds” if the feature truly belongs primitively to crook-taloned birds. Thus the divisions one uses must include the form that does in fact primitively exhibit the feature. The example could be expanded so that more than one form of bird is given that possesses a hooked-beak (are there any?), and thus the “A-type” explanation would be that a bird possesses a hooked-beak because it is EITHER this form OR that. The project would then be to identify other features the two forms share.

hooked beaks? Because they are crook-taloned (A-type explanation). But why do crook-taloned birds possess hooked beaks? This is the new question or “problem” under consideration, and the procedure of using the existing set of divisions allowed for the identification of the proper level of generality at which the B-type explanation is to be sought. Lennox claims that the concern with identifying the widest class to which a feature belongs primitively is clearly present in *HA*, and further that this concern reflects the very methodological prescriptions set forth in *APo*, as well as *PA I*.

Both Lennox and Gotthelf point to the relative ubiquity of a certain *hosa . . . panta* locution (and its variants) that seems aimed at identifying a subject class that possesses a given feature primitively.⁴⁴ Often times the subject class is marked-off as the group of animals that possess a certain feature, such that the resultant proposition states a correlation between two features (i.e. as many animals / birds / four-footed live-bearers / etc. as possess feature X, all also possess feature Y). Such correlations typically do not place animal *kinds* in the subject role, and both Gotthelf and Lennox argue, following Balme and others, that in large measure the *HA* is relatively unconcerned with identifying animal kinds or establishing a classification of them. Instead, as Balme emphasized, the focus is on features/characteristics, and the correlations between *them*. For instance, using the peregrine falcon example again, clearly *bird* refers to a kind of animal, as does *peregrine falcon*, but it is not clear that the features *crook-taloned* or *hook-beaked* serve to divide the kind *bird* into *forms* that are somehow ontologically privileged (i.e. are sub-*genê* that fall under the *megiston genos* “bird,” under which the *eidos* “peregrine falcon” ultimately falls). Instead, the emphasis is on identifying the features exhibited by animals, many of which (such as *crook-taloned* and *hook-beaked*) are possessed only by certain

⁴⁴ Lennox 1987a; Gotthelf 1988, pp. 313-5; 2012b, pp. 272-3.

kinds of animals (in this case *birds*), and finding correlations between those features at the highest level of generality. This shows that in *HA* Aristotle was less concerned with establishing a classification of animal kinds (understood as some ontologically preferred way of classifying animals), but was more concerned with finding correlations between features.⁴⁵

But what of the relationship between the *HA* and the notion of *hoti/dioti* discussed in *APo.* II? On one plausible reading, a *hoti*-level proposition is one that connects a subject and an attribute universally, is established to be true, but is lacking a causal explanation, understood as the identification of the essential feature of the subject responsible for the presence of the attribute. On Balme's reading of *HA*, the aim of the treatise is to lay out and analyze the attributes, but not to determine which subjects exhibit the attributes, nor *how* they exhibit them (essentially, *per se* incidental, etc.). The method of correlating features in order to uncover "clues" to the causes suggests that such correlations will reveal causal relationships between *attributes*. The causally relevant attributes can then be used to mark off animal kinds, in so far as they will be the attributes that make up the *essence* of an animal kind, but this is not an aim attributed to *HA*. On the Balme/Gotthelf/Lennox reading, what are the primary *hoti* facts collected in *HA*, if not facts that link attributes to subjects that refer to animal kinds? Are they the correlations expressed by the *hosa . . .panta* statements and the like, or are they simply the facts that *some animals possess feature X*? If they are the latter, then the correlations represent a step

⁴⁵ However, if animal kinds are understood simply as "differentiae classes", then one may be able to use the correlations to mark off animal kinds, e.g. by finding the few features to which many others are correlated.

beyond the mere collection of *hoti* facts, and perhaps represent initial attempts at zeroing in on causal explanations.

1.1.4 Charles

David Charles, in his book *Aristotle on Meaning and Essence*, provides a very different interpretation of the aims and methodology of the *HA*. However, like Balme, Gotthelf, and especially Lennox, he bases his interpretation in part on his reading of *APo.*, and especially book II. Thus we have different readings of the *Analytics* leading to different readings of *HA*.

In the first part of his book, Charles lays out his case for attributing to Aristotle a three-stage view of scientific investigation, derived primarily from his reading of *APo.* II.1-10.⁴⁶ The stages focus on the grasp of *kinds*, whether they exist and what their essential natures are. Charles develops an account of Aristotelian definition that ties it closely to the notions of explanation and demonstration. According to Charles, the *Analytics* prescribes that the heart of a definition of a kind will contain a single, essential feature that explains the presence of the other definitional features of the kind, as well as the other *per se* predications. He understands the project of the *HA* as determining both the *features* that hold of animal kinds in themselves, as well as the identification of the relevant kinds and sub-kinds by means of identifying the *differentiae* that properly divide *genê* into *eidê*. He reads *PA* I as recommending that the first goal of biological research is to identify those features that belong *per se* to the correctly marked-off kinds of animals. Following this interpretation, he reads the “*kai*” in the *HA* I.6 passage “first establish the differences *and* attributes” as a true conjunction—that is, the goal of the *historia* is to

⁴⁶ See Charles 2000, ch. 2.

correctly identify two different sorts of things, differentiae and attributes, and to identify them *as such*.

By attributing to *diaphorai* in the *HA* I.6 passage a “technical” sense, Charles argues that a central goal of the *HA* is to establish which kinds exist and which attributes belong to them. This, to Charles, implies a “taxonomic task” of laying out the kinds.⁴⁷ He ascribes to the *HA* the “double aim” of laying out the features and identifying the kinds to which they belong:

Historiai are, thus, essential first steps towards causal explanation, and ones which involve determining which genera and species, in reality, differ from each other . . . and which properties genuinely belong to each kind or sub-kind.⁴⁸

Charles reads *HA* I.1-5 as laying the groundwork for the identification of the *megista genê* discussed in I.6. In effect, he sees these chapters as developing the notion of a common nature (as discussed in *PA* I.4) in terms of the basic life or soul functions: breathing, locomotion, reproduction, and nutrition.⁴⁹ The method of *HA* is not simply an “empirical” one of listing differentiae and searching for shared groups of attributes; instead the focus is on a short-list of certain basic soul functions:

⁴⁷ Charles 2000, p. 315n9.

⁴⁸ Charles 2000, p. 316.

⁴⁹ Charles 2000: “Thus certain activities (such as feeding, moving, breathing, and reproducing) are taken as the central ones in characterizing differences between animals.” (318) “In the case of a unified genus, there is a distinctive way of moving, reproducing, feeding, and breathing. Difference with respect to one of these life functions undermines the unity of the genus.” (319)

. . . Aristotle's project in the *Historia Animalium* is not that of determining the relevant genera and species merely by collecting a 'large group' of counter-predicable properties, and then using division to establish the species. Nor does he merely seek those general *differentiae* which are distinguished by continuous variations of their sensible affections. The significance he attaches to differences in basic soul functions shows that he is making major assumptions about what features are important in establishing genuinely common natures. His enquiry is, in effect, the progressively more systematic elucidation of controlling concepts of this type, one which results empirically in differentiation into kinds and sub-kinds. It involves both empirical data and a powerful background theory." (324-325)

This method of identifying kinds of animals is in line, Charles argues, with the prescriptions from *APo.* II.13, a difficult chapter of which he provides a novel interpretation.⁵⁰ In summary, he reads *APo.* II.13 as laying out a "non-*ad hoc*" procedure for determining the *differentiae* that divide *genê* into *eidê*, and sees that procedure, with some modification, at work in the opening chapters of *HA* I. Regarding the incompleteness of the taxonomic classification provided in *HA*, which all commentators seem to agree on, Charles argues that the *HA* is meant to provide only the "basic outline for a system of classification rather than to carry it through in every detail." (326). Like Lloyd,⁵¹ Charles argues that the incompleteness of the classification in *HA* does not indicate that Aristotle was uninterested in classification, or that he was engaged in a wholly different task of simply collecting *differentiae*. (326 n6) According to Charles, Aristotle's

⁵⁰ See Charles 2000, ch. 9.

⁵¹ Prefatory note to reprint of 1961 article on classification.

biological research program required that he first find a way of correctly distinguishing different kinds of animals, and then identify which features are unique to the kinds so distinguished – “it is an essential preliminary for explanation of this type that one grasp genuine kinds and their non-accidental properties. This is what grasping the relevant ‘the that’ (i.e. *to hoti*) consists in.” (329)

1.2 REFLECTION

In the foregoing discussions I have attempted to present the reading of *HA* by Gotthelf and Lennox as an extension of Balme’s interpretation, but an important one that adds much to our understanding of the treatise. In this regard, I am following Gotthelf and Lennox’s own words on the relationship between their writings. I have contrasted the Balme/Lennox/Gotthelf reading of *HA* with that of Charles. In this respect, I am aided by Lennox’s own statement of disagreement with Charles, based on an exchange of essays dating back to 1990. It is of interest that Charles’s restatement of his position, which appeared in his 2000 book, is in large part a re-trenchment of his initial position, supplemented with text and a number of footnotes aimed at deflecting or, indeed, disarming, many of the criticisms leveled by Lennox in 1990. In other words, Lennox’s criticisms seemed to have failed to persuade Charles that his reading of *HA* is incorrect, and Charles’s own position is further supported by his forceful reading of many difficult passages from the *Analytics*. It seems we have before us today the most sophisticated interpretations of Aristotle’s *historia* of animals ever before on offer, yet they differ and disagree in important and fundamental ways.

If we accept an interpretation of *HA* that situates it within the context of Aristotle’s notions of explanation and demonstration, as discussed in the *Analytics* (as Lennox, Gotthelf, and

Charles do), and, in particular, if we associate a *historia* with a preliminary stage of inquiry aimed at establishing what APo II.1 designates as *to hoti*, i.e. the facts in need of explanation, then is it the case that such facts take the form of an attribute predicated of a subject, where the subject identifies a specific kind? Or are the *hoti*-level facts reported in the *HA* concerned primarily with attributes, and not with subject kinds? That is, the *hoti*-level facts reported in a *historia* may emphasize predicative relationships between attributes, without exhibiting great concern with kind/form divisions of subjects.⁵² Further, is the explanatory project embarked upon in such works as *PA* one that *requires* the correct identification of animal kinds in order that proper demonstrations may be constructed? More generally, my concern is with the ways in which Aristotle envisioned a *historia* as not only preceding a subsequent causal investigation, but potentially *facilitating* the discovery of causes, or at least *prefiguring* the identification of such causes.⁵³

⁵² As I will try to develop below, this is the view I hold, at least as it pertains to *HA*, which I read as providing kind/form analyses of *attributes*, as well as correlations among them (e.g. as many as possess attribute X, also possess attribute Y). But note that even on this interpretation, such correlations, as presented by Aristotle, typically range over certain kinds of animals, most typically over the *megista genê*, such that the *hoti* facts presented often have the form of “as many e.g. *birds* as possess attribute X also possess attribute Y.” In such an instance one might argue that e.g. the first attribute listed differentiates the kind *bird* into a specific form, thus rendering the *hoti*-fact one that essentially identifies a kind/form as subject. However I find no great evidence to support the notion that Aristotle held that the attributes he discussed functioned as specific differences in this manner.

⁵³ By *prefiguring* here I mean that the *historia* may be composed so as to guide/prepare the reader for the identification of causes, which may already be known at the time of its composition. In this case, structuring the *historia* in this manner may serve pedagogical purposes.

2.0 PRELIMINARY CONSIDERATIONS I: REFERENCES TO *HISTORIA* IN THE ARISTOTELIAN CORPUS

Prior to analyzing the *HA* itself, it is useful to first see if we can develop Aristotle's notion of *historia* by examining his other uses of the term in the corpus. In so doing we will come to the treatise armed, as it were, with a sense of the role Aristotle envisioned *historia* playing. As I argued in the preceding chapter, two different pictures of what a *historia* is meant to accomplish emerge from discussions in the prior literature. In particular, the Balme/Gotthelf/Lennox view holds that the primary purpose of a *historia* of animals is to collect facts about the features and characteristics animals exhibit, without focusing great attention on the *kinds* of animals that exhibit those features. The goal of collecting this information is, first, to identify the various features and attributes actually exhibited by animals, and, second, to organize the features in order to show their similarities and differences according to kind, form, and analogy. Gotthelf and Lennox additionally argue that an aim of the *historia* is to identify primitively universal correlations between features in order to aid in the discovery of causal relationships. Charles, on the other hand, emphasizes the importance of identifying the kinds of animals that exhibit the features studied in the *historia*, and to differentiate between features that divide kinds into sub-kinds (i.e. the *diaphorai*), and features that are exhibited *per se* by the kinds and sub-kinds so identified (i.e. the *sumbebêkota kath'hauto*). This, he argues, is the important first step that a *historia* plays in the investigation leading to causal explanation.

In the following sections I discuss Aristotle's use of the term *historia* and consider whether the term implies any specific stage of investigation. I will review the many appearances of the term in the biological corpus where it is used as a reference to what appears to be the *HA*, and consider whether these references give us any insight into what a *historia* should include, how it should be composed, and what one might expect to gain from reading it.

2.1 MEANING OF *HISTORIA*

The term *historia* is perhaps first, and best, known to us as belonging to the titles of the great "histories" written by Herodotus and Thucydides.⁵⁴ These works are in many ways similar to what we count today as history, certain historiographic differences aside. That is, they are accounts (however accurate or true) of particular actions, done by particular people, at particular times in the past. Despite their focus on such particulars, both Thucydides and Herodotus recognize a greater purpose or aim of their histories, beyond merely retaining for posterity the details regarding past events. For example, following the opening of his history, in which he claims that the events surrounding the Peloponnesian War represent perhaps the greatest "movement" of peoples in all of human history, Thucydides states his true purpose for recounting the details of the war:

[1] The absence of romance will, I fear, detract somewhat from its [i.e. the history's] interest; but if it be judged useful by those inquirers who desire an exact

⁵⁴ Interestingly the word *historia* does not appear anywhere in Thucydides' great work, other than in the titles to the books.

knowledge of the past as an aid to the understanding of the future, which in the course of human things must resemble if it does not reflect it, I shall be content. In fine, I have written my work, not as an essay which is to win the applause of the moment, but as a possession for all time. (I.22.4)⁵⁵

καὶ

ἐς μὲν ἀκρόασιν ἴσως τὸ μὴ μυθῶδες αὐτῶν ἀτερπέστερον
φανεῖται· ὅσοι δὲ βουλήσονται τῶν τε γενομένων τὸ σαφὲς
σκοπεῖν καὶ τῶν μελλόντων ποτὲ αὖθις κατὰ τὸ ἀνθρώπινον
τοιούτων καὶ παραπλησίων ἔσεσθαι, ὠφέλιμα κρίνειν αὐτὰ
ἀρκούντως ἔξει. κτῆμά τε ἐς αἰεὶ μᾶλλον ἢ ἀγώνισμα ἐς τὸ
παραχρῆμα ἀκούειν ζύγκεται.

Thucydides' true interest (or at least a primary interest) is to preserve the knowledge of the past in order to better understand the future, since in human affairs, the future is bound to resemble (or indeed "reflect") the past. That is, the focus on past events is (at least in part) for the sake of *understanding* and in some sense *explaining* those that are happening now or have yet to happen. In this passage he does not expound upon the manner by which one might use knowledge of the past to gain insight into the future, but we might speculate that his intention in studying the past is to reveal certain *universal propositions* regarding the affairs of men—*lessons*, as it were, that transcend particular time and space, which may be applied to future events to better understand the changing course of history.

⁵⁵ Trans. Crawley, from Strassler (ed.) 1996.

Herodotus too recognizes a greater purpose to his history than mere antiquarian interest. Here are the opening lines of his great work:

[2] Herodotus of Halicarnassus here presents his *historia* so that human events do not fade with time. May the great and wonderful deeds—some brought forth by the Hellenes, others by the barbarians—not go unsung; as well as the causes (*di' ên aitiên*) that led them to make war on each other. (I.1.1)⁵⁶

Ἡροδότου Θουρίου ἱστορίας ἀπόδεξις ἦδε, ὥς μήτε τὰ
γενόμενα ἐξ ἀνθρώπων τῷ χρόνῳ ἐξίτηλα γένηται, μήτε
ἔργα μεγάλα τε καὶ θωμαστά, τὰ μὲν Ἕλλησι, τὰ δὲ βαρ-
βάροισι ἀποδεχθέντα, ἀκλέα γένηται, τὰ τε ἄλλα καὶ δι' ἣν
αἰτίην ἐπολέμησαν ἀλλήλοισι.

Similar to the passage from Thucydides, Herodotus here claims that preservation of the knowledge of past events serves a greater purpose than merely imparting to it a measure of immortality (though he clearly sees this as an important goal). In addition, he believes that a *historia* can make clear the causes (*aitia*) that were responsible for bringing these peoples to war. The statement is of particular interest, given the relationship between *historia* and *aitia* Aristotle eludes to in the methodological passage from *HA* I.6 (passage [13] below).

In short, there is some basis for regarding a *historia* as something more than a mere collection of facts (much less, facts tethered to particular times and places). Rather we see, in the writings of

⁵⁶ Tr. Purvis, from Strassler (ed.) 2009.

these two “fathers of history,” a clear interest in their work being used to *interpret, understand,* and *explain* not just the past, but the present and future as well.

2.2 USES OF THE TERM *HISTORIA* IN THE ARISTOTELIAN CORPUS

But what exactly does Aristotle mean by *historia*?⁵⁷ Although it is not clear that Aristotle intended the term to appear in the title of the work we know as the *HA*,⁵⁸ we need not rely on this title alone for evidence that the term applies to the treatise, or the project embodied by the treatise. Not only does the term appear in the *HA*, in what seems to be a reference to the work at hand,⁵⁹ it is also commonly used in other Aristotelian treatises as a reference to what most scholars take to be *HA*.⁶⁰

Still, the term, as it was used by Aristotle, appears to have had a range of meanings, not all of which may be applicable to the project of the *HA*. A TLG search reveals that Aristotle did not often use the term *historia* outside of specific references to the *HA* or some other similar treatise. In those places where he does employ the term presumably with its traditional or standard meaning, it often seems to carry with it either something similar to our notion of “history,” or the basic notion of an *inquiry, study, or investigation* (or the reports or results of these), perhaps synonymous with *theoria, zêtêsis, or skepsis*. Such instances do not appear to

⁵⁷ See Louis 1955; Lennox 1991, n4; Gotthelf 1988, n6.

⁵⁸ Balme 1991, p. 7 notes that certain manuscripts make reference to *HA* as the treatise on the “parts of animals”, reflecting the words in the first line of the treatise.

⁵⁹ *HA* I.6, 491a12 (passage [13] below).

⁶⁰ It is difficult to confirm that the various references to a *historia* of animals in the corpus are in fact references to the *HA* as we know it today. Often passages in the *HA* may be found that correspond well to the given reference, but that, in itself, does not secure the reference to our *HA*.

call out any particular stage of inquiry. However, as we shall see, *some* such uses *do* seem to make reference to a specific, early, pre-explanatory stage of investigation, one that combines, as it were, the notions of *historia* as “history” and “investigation.” It will be these uses that point the way towards understanding the role of *historia*, and *HA*, in Aristotle study of animals.

In the following sections I discuss the varying uses of the term *historia* in the Aristotelian corpus. I argue that, though these varying uses tend to have shades of differing meaning, all converge on the same general sense, and it is possible to use this general sense to better understand the more “technical” sense in which the term is used by Aristotle in reference to a particular, early stage of investigation. I divide the uses of the term into two main categories: general uses of the term (section 4), and uses that appear to act as specific references to *HA* (section 5). The first category will assist us in developing Aristotle’s more technical sense of *historia* (the sense I believe is relevant to *HA*), while the second will help fill out the picture of the content one might expect to find in the *historia* of animals, and provide some sense of the role the *historia* should play.

2.2.1 General uses of *historia*

Aristotle’s use of the term *historia* spans a range of apparent meanings, but they are related. I shall consider nine passages in which the term *historia* appears and is used in a “general” way, i.e. not as a reference to *HA*.⁶¹

⁶¹ The passages are arranged in such a manner as to facilitate the narrative flow of my discussion, and not e.g. by Bekker number.

2.2.2 *Historia* as “story” and “history”

The first passages to consider are those in which the term *historia* is used in much the same manner as our word “history.” The first such passage appears in *Mir. Ausc.*⁶²:

[3] In the city called Utica in Libya, which is situated, as they say, on the gulf between the promontory of Hermes and that of Hippos, and about two hundred furlongs beyond Carthage (now Utica also is said to have been founded by Phoenicians two hundred and eighty-seven years before Carthage itself, as is recorded in the Phoenician histories (*historiais*)) men state that . . . (*Mir. Ausc.* 134, 844a6-11)⁶³

844a6 Τῆς δὲ Λιβύης ἐν Ἰτύκῃ τῇ καλουμένῃ, ἣ κεῖται
μέν, ὡς λέγουσιν, ἐν τῷ κόλπῳ τῷ μεταξὺ Ἑρμαίας καὶ
τῆς Ἰπποῦ ἄκρας, ἐπέκεινα δὲ Καρχηδόνης ὡς σταδίου
διακοσίου (ἢ καὶ πρότερον κτισθῆναι λέγεται ὑπὸ Φοινίκων
a10 αὐτῆς τῆς Καρχηδόνης ἔτεσι διακοσίοις ὀγδοήκοντα ἐπτά,
ὡς ἀναγράφεται ἐν ταῖς Φοινικικαῖς ἱστορίαις γίνεσθαι

⁶² It may be objected that treatises such as *Mir. Ausc.* are not authentically Aristotelian, and thus should not be used to fix the meaning of a term as it was used by Aristotle. While I recognize this problem, my response is (i) the spuriousness of such treatises is, as I understand it, still debated (more for some, less for others) and thus their consideration is still warranted, even if they should be taken with the proverbial grain of salt; and (ii) even if such treatises were not written by the hand of Aristotle himself, it is quite possible that they were composed by close associates, who very well may have used such terms in similar, if not identical, ways. In either case, I believe a consideration of these texts is instructive.

⁶³ Translated by L.D. Dowdall, in Barnes 1984.

φασιν . . .

In this passage *historia* appears to be used in much the same sense as in Herodotus and Thucydides, and corresponds to our notion of “history.” The fact of the founding of Utica by the Phoenicians some three centuries before Carthage is recorded in the Phoenician *historiai*. While the term *historiai* may just be what these records of past events were commonly called, it seems reasonable that the term *historia* itself carried, or came to carry, this meaning, and was not used merely as a proper name in reference to such works.

The next two passages both appear in the *Poetics*:

[4] And it is also evident from the things that have been said that the work of the poet is to speak not of things that have happened but of the sort of thing that might happen and possibilities that come from what is likely or necessary. For the historian (*historichos*) and the poet differ not by speaking in metrical verse or without meter (for it would be possible to put the writings of Herodotus into meter, and they would be a *historia* with meter no less than without it). Rather, they differ in this, that the one speaks of things that have happened, but the other of the sort of things that might happen. For this reason too, poetry is a more philosophical and more serious thing than history *historia*, since poetry speaks more of things that are universal, and *historia* of things that are particular. (*Poet.* 9, 1451a36-b7)⁶⁴

⁶⁴ Trans. Sachs 2006.

1451a36 Φανερόν δὲ ἐκ τῶν εἰρημένων καὶ ὅτι οὐ τὸ τὰ γενόμενα λέγειν, τοῦτο ποιητοῦ ἔργον ἐστίν, ἀλλ' οἷα ἂν γένοιτο καὶ τὰ δυνατὰ κατὰ τὸ εἰκὸς ἢ τὸ ἀναγκαῖον. ὁ γὰρ

b1 ἱστορικὸς καὶ ὁ ποιητὴς οὐ τῷ ἢ ἔμμετρα λέγειν ἢ ἄμετρα διαφέρουσιν (εἴη γὰρ ἂν τὰ Ἡροδότου εἰς μέτρα τεθῆναι καὶ οὐδὲν ἦττον ἂν εἴη ἱστορία τις μετὰ μέτρου ἢ ἄνευ μέτρων). ἀλλὰ τούτῳ διαφέρει, τῷ τὸν μὲν τὰ γενόμενα λέγειν, τὸν δὲ οἷα ἂν γένοιτο. διὸ καὶ φιλοσοφώτερον καὶ σπουδαιότερον ποίησις ἱστορίας ἐστίν· ἡ μὲν γὰρ ποίησις μᾶλλον τὰ καθόλου, ἡ δ' ἱστορία τὰ καθ' ἕκαστον λέγει.

b5

[5] About the art of narrative imitation in meter, it is clear that one ought to organize the stories just as in tragedies, as dramatic, concerned with one action, whole and complete, having a beginning, middle, and end, in order that they might, like one whole living thing, produce the appropriate sort of pleasure; the putting together of them ought not to be made like that of *historiai*, in which it is necessary that they make a display not of one action but of one time, with all the things that happen in that time involving one or more people, each of the events related to the others in any random way. (*Poet.* 23, 1459a17-24)⁶⁵

⁶⁵ Trans. Sachs 2006.

1459a17 Περὶ δὲ τῆς διηγηματικῆς καὶ ἐν μέτρῳ μιμητικῆς,
 ὅτι δεῖ τοὺς μύθους καθάπερ ἐν ταῖς τραγωδίαις συνιστάναι
 δραματικούς καὶ περὶ μίαν πρᾶξιν ὅλην καὶ τελείαν ἔχου-
 a20 σαν ἀρχὴν καὶ μέσα καὶ τέλος, ἵν' ὥσπερ ζῶον ἐν ὅλῳ
 ποιῇ τὴν οἰκείαν ἡδονήν, δῆλον, καὶ μὴ ὁμοίας ἱστορίαις τὰς
 συνθέσεις εἶναι, ἐν αἷς ἀνάγκη οὐχὶ μιᾶς πράξεως ποιεῖσθαι
 δήλωσιν ἄλλ' ἐνὸς χρόνου, ὅσα ἐν τούτῳ συνέβη περὶ ἓνα
 ἢ πλείους, ὧν ἕκαστον ὡς ἔτυχεν ἔχει πρὸς ἄλληλα.

In both [4] and [5] poetry is contrasted with *historia*, which seems to take on the sense of our “history.” In [4], poetry is said to be *philosophôteron* and *spoudaioteron* than history because poetry’s subject matter is more universal and deals with the sort of thing that *might have been*, while history deals with particular things in the past that *have been*. That is, the historian is restricted in his writing by the events that actually did take place. He is not free to craft his story as he chooses, as the poet might, and thus he is unable to tailor his story to meet the goals of his choosing. In [5], poetry is said to deal with a single action (*mian praxin*) that possesses a unity similar to that of an animal, while history deals with a single period of time (*henos chronos*) and all the events that took place during that time, whatever their relation to one another. The passages emphasize, as did passage [4], the factual nature of a *historia*, that it is meant to document the events that actually did happen during a certain time.

While the previous uses of *historia* agreed best with our term “history,” this next passage, from the *Problēmata*, uses the term in a sense closer to our term “story” or “narrative”:

[6] Why do we listen to *historiai* organized around one thing with more pleasure than those that deal with many? Is it because we pay more attention, and listen with more pleasure, to what is more easily comprehended? But the limited is more easily comprehended than the unlimited. Now what is one is defined, whereas what is many partakes in the infinite. (*Prob.* XVIII.9, 917b8-12)⁶⁶

917b8 Διὰ τί ποτε τῶν ἱστοριῶν ἥδιον ἀκούομεν τῶν περὶ ἓν
συνεστηκυῶν ἢ τῶν περὶ πολλὰ πραγματευομένων; ἢ διότι
b10 τοῖς γνωριμωτέροις μᾶλλον προσέχομεν καὶ ἥδιον αὐτῶν
ἀκούομεν· γνωριμώτερον δέ ἐστι τὸ ὠρισμένον τοῦ ἀορίστου. τὸ
μὲν οὖν ἐν ὥρισται, τὰ δὲ πολλὰ τοῦ ἀπείρου μετέχει.

The *problêma* suggests that we enjoy listening to stories that center on a single point or topic rather than many, because a single thing is more easily “comprehended” or “understood” (*gnôrimôteros*), since the many shares in the infinite, which presumably is not understandable. A *historia*, in this sense, is a recounting of actions, deeds, events, happenings, etc., and does not necessarily imply any sort of explanatory reasoning. However, the *problêma* seems general enough to include any sort of expository writing, and not just a “history” in our sense.

⁶⁶ Trans. Mayhew 2011. Mayhew translates *historia* as “historical accounts,” but this seems overly influenced by our English cognate word. Nothing in the problem, or the surrounding problems, suggests that this *problêma* deals exclusively with historical accounts, versus e.g. other sorts of stories, narratives, etc. The traditional title of *Prob.* XVIII is *hosa peri philologian*, which Mayhew translates as “Problems Connected with the Love of Letters,” which he glosses as “love of (or interest in) literature or letters” (p. 515). The focus of the problems of this book is on reading and listening in general, and typically not on specific kinds of writing or speaking.

2.2.3 *Historia* as “investigation” or “inquiry”

Whereas in the preceding examples the term *historia* took on a meaning often quite similar to our “history,” in the following passages the term appears to mean something closer to “investigation” or “inquiry,” or a report of the results of an investigation or inquiry.

I consider first a passage from the *Rhetoric* that arguably “tows the line” between the senses of “history” and “investigation”:

[7] So it is evident that for lawmaking, travels around the earth are useful, since it is possible to grasp the laws of various nations from them, and for political advice, the *historiai* contained in writings about the deeds of those nations, but all these things are work for the study of politics and not of rhetoric. (*Rhet.* I.4 1360a33-37)⁶⁷

1360a33	ὥστε δῆλον ὅτι
	πρὸς μὲν τὴν νομοθεσίαν αἱ τῆς γῆς περίοδοι χρήσιμοι ἐν-
a35	τεῦθεν γὰρ λαβεῖν ἔστιν τοὺς τῶν ἐθνῶν νόμους, πρὸς δὲ τὰς
	πολιτικὰς συμβουλὰς αἱ τῶν περὶ τὰς πράξεις γραφόντων ἱστο-
	ρίαι· ἅπαντα δὲ ταῦτα πολιτικῆς ἀλλ’ οὐ ρητορικῆς ἔργον ἐστίν.

⁶⁷ Trans. Sachs 2009.

Here one might understand the phrase “*historiai* contained in the writings about the deeds of nations” to be what we would generally call a “history,” or one might take the *historiai* here to refer to something more general, since Aristotle specifies the kind of *historia* he is referring to, namely the kind “contained in the writing about the deeds of those nations.” One might argue that a “history,” in our sense, *is* the writings about the deeds of nations. Thus *historia*, as used here, might refer to a more general “investigation.” As such, Sachs translates *historiai* here as “investigations,” while Roberts⁶⁸ loosely (or rather, “interpretively”) translates the phrase as “the researches of historians.” Since these *historiai* are to be consulted for “political advice” (*tas politikas sumboulas*), it may be that they contain not just an account of the deeds of the nations, but rather some sort of lessons or maxims derived from these accounts. So understood the purpose of the *historiai* would be to cull or distill these lessons from the historical accounts.

Whereas the use of *historia* in the previous passage from *Rhet.* was somewhat ambiguous as to whether the term would be best rendered by our “history” or “investigation,” this next passage, from *de Caelo*, uses the term in a less ambiguous manner for something akin to “investigation”:

[8] . . . it is clear that for the most part it is the case that the *historia* of nature is about bodies; for all natural substances either are bodies or come to be from bodies and magnitudes. (*DC* III.1, 298b1-4)

298b1

. . . φανερόν ὅτι τὴν

⁶⁸ In Barnes 1984.

πλείστην συμβαίνει τῆς περὶ φύσεως ἱστορίας περὶ σωμάτων
εἶναι· πᾶσαι γὰρ αἱ φυσικαὶ οὐσίαι ἢ σώματα ἢ μετὰ σω-
μάτων γίνονται καὶ μεγεθῶν.

In this passage Aristotle argues that the *historia* of nature is primarily concerned with bodies (*sômata*), since all natural substances (*phusikai ousiai*) either are bodies or are dependent upon them (this last claim is deduced in the lines immediately preceding, 498a27-b2). The passage reverberates with verbal echoes of the opening lines of *DC* I.1, which state:

[9] The *epistêmê* of nature is for the most part clearly about both bodies and magnitudes and those things that are properties and motions of these, and further of principles, as many as belong to these sorts of substances. For among things that are put together by nature, some are bodies and magnitudes, others belong to bodies and magnitudes, and others are the principles of these. (*DC* I.1, 268a1-6)

268a1 Ἡ περὶ φύσεως ἐπιστήμη σχεδὸν ἢ πλείστη φαίνε-
ται περί τε σώματα καὶ μεγέθη καὶ τὰ τούτων οὗσα πάθη καὶ
τὰς κινήσεις, ἔτι δὲ περὶ τὰς ἀρχάς, ὅσαι τῆς τοιαύτης οὐσίας
εἰσὶν· τῶν γὰρ φύσει συνεστώτων τὰ μὲν ἐστὶ σώματα καὶ
a5 μεγέθη, τὰ δ' ἔχει σῶμα καὶ μέγεθος, τὰ δ' ἀρχαὶ τῶν
ἐχόντων εἰσὶν.

The phrase *tês peri phuseôs historias* in [9] appears to function similarly to *hê peri phuseôs epistêmê* in [10], but are they therefore synonymous? *Epistêmê*, in this context, is used to refer to an organized body of knowledge, and is often translated as “science.” Here *historia* may refer, not so much to the end result of an investigation, but rather to the investigation itself—the process leading to the end result. Both passages appear at the beginnings of their respective books, in the introductory discussions meant to situate the subject matter currently at hand within a broader investigative context. If Aristotle is making a distinction in these passages between the inquiry or investigation into nature (*historia*), and the results of that inquiry (*epistêmê*), it is not obvious from the context, and does not seem especially relevant to the matter at hand. Rather, it seems these terms are here used synonymously to refer to the project of investigating nature.

The next passage, from the beginning of *de Anima*, uses the term *historia* in a manner similar to passage [8]:

[10] Since we consider knowledge (*eidêsin*) to be something beautiful and honored, the one sort more so than another either on account of its precision or because it is about better and more wondrous things, on both these accounts we should with good reason rank the *historia* about the soul among the primary studies. And it seems that acquaintance with it (*hê gnôsis autês*) contributes greatly toward all truth and especially toward the truth about nature, since the soul is in some way the principle of living things. (*DA* I.1 402a1-7)⁶⁹

⁶⁹ Trans. Sachs 2001.

402a1 Τῶν καλῶν καὶ τιμίῳ τὴν εἶδῃσιν ὑπολαμβάνοντες, μᾶλ-
λον δ' ἐτέραν ἐτέρας ἢ κατ' ἀκρίβειαν ἢ τῷ βελτιόνων τε
καὶ θαυμασιωτέρων εἶναι, δι' ἀμφοτέρω ταῦτα τὴν περὶ τῆς ψυ-
χῆς ἱστορίαν εὐλόγως ἂν ἐν πρώτοις τιθείημεν. δοκεῖ δὲ καὶ
a5 πρὸς ἀλήθειαν ἅπασαν ἢ γνῶσις αὐτῆς μεγάλη συμβάλ-
λεσθαι, μάλιστα δὲ πρὸς τὴν φύσιν· ἔστι γὰρ οἶον ἀρχὴ
τῶν ζώων.

In this passage the *historia* of soul is argued to rank first or be primary because the knowledge (*eidêsis*) that results from the *historia* is both more precise and pertains to a more wonderful thing, relative to other *historiai*, and because this knowledge aids in the understanding of nature, since the soul is a principle of living things—the quintessential natural substances. The *historia* of soul, on this reading, results in the knowledge of soul, and thus is best translated as “investigation” or “inquiry.” The use here is very similar to that of passage [8] from *DC*: both use *historia* to denote a study or investigation.

This usage is in keeping with the use of the term in the next passage, from *PA* I.1:

[11] So it is clear that for the *historia* into nature, too, there should be certain standards, such that referring to them one can appraise the manner of its proofs, apart from the question of what the truth is, whether thus or otherwise. (*PA* I.1, 639a12-15)⁷⁰

⁷⁰ Trans. Lennox 2001.

639a12 Ὡστε δῆλον ὅτι καὶ τῆς περὶ φύσιν ἱστορίας δεῖ τινὰς
 ὑπάρχειν ὅρους τοιούτους πρὸς οὓς ἀναφέρων ἀποδέξεται τὸν
 τρόπον τῶν δεικνυμένων, χωρὶς τοῦ πῶς ἔχει τὰληθές,
 a15 εἴτε οὕτως εἴτε ἄλλως.

Similar to passages [8] and [10] above, this passage appears in the introductory remarks of *PA I.1*, which focus on the general features to which any scientifically conducted investigation should conform.⁷¹ In this passage, Aristotle claims that, for the *historia* of nature, there should be certain standards (*horous*) according to which one might appraise the manner of its proofs (*deiknumenôn*). Thus the *historia* of nature, as it is used here, will include proofs of the various claims it makes: the *historia* involves not just factual claims, but also proofs of these claims. Thus “the *historia* into nature” refers to the entire project of the investigation or inquiry into nature, and is not restricted to a collection or report of facts about nature, devoid of explanatory content.

Thus we have moved from a sense of *historia* as something akin to our “history” to one closer to our “inquiry” or “investigation.” This next passage, from *Prior Analytics*, seems to use the term in a more restricted sense, referring to a particular stage of investigation:

[12] Consequently, if the facts concerning any subject have been grasped, we are already prepared to bring the demonstrations readily to light. For if nothing that truly belongs to the subjects has been left out of our *historia*, then concerning

⁷¹ The first part of *PA I.1* is especially rich with words that denote investigation, inquiry, research, and knowledge: *theoria*, *methodos*, 639a1; *epistêmê*, a3; *historia*, a12.

every fact, if a demonstration for it exists, we will be able to find that demonstration and demonstrate it, while if it does not naturally have a demonstration, we will be able to make that evident. (*APr.* I.30, 46a22-27)⁷²

46a22

ὥστ' ἐὰν ληφθῇ

τὰ ὑπάρχοντα περὶ ἕκαστον, ἡμέτερον ἤδη τὰς ἀποδείξεις
έτοιμῶς ἐμφανίζειν. εἰ γὰρ μηδὲν κατὰ τὴν ἱστορίαν παρα-

a25

λειφθεῖη τῶν ἀληθῶς ὑπαρχόντων τοῖς πράγμασιν, ἔξομεν
περὶ ἅπαντος οὗ μὲν ἔστιν ἀπόδειξις, ταύτην εὐρεῖν καὶ ἀπο-
δεικνύναι, οὗ δὲ μὴ πέφυκεν ἀπόδειξις, τοῦτο ποιεῖν φανερόν.

In *APr.* I.27-30 Aristotle discusses a method for identifying middle terms that can serve to connect the major and minor terms of a proposition that one wishes to prove.⁷³ The method comprises identifying all the terms that “follow” the major term, and all the terms that “are followed by” the minor term, and comparing the lists in search of common terms. The passage suggests that the *historia* is to contain all these facts about what is predicated of the major term, and what the minor term is predicated of. In this way, if a deduction can be constructed, the *historia* will help bring it to light by including all such facts. This use of the term suggests that a *historia* is primarily a collection of facts regarding the subject matter under consideration, one which facilitates the construction of deductions, and presumably *precedes* attempts at demonstration. The factual nature of the *historia* here agrees well with the uses of the term in

⁷² Trans. Smith 1989.

⁷³ See Lennox 1991, pp. 43-45, and ch. 6 below for a fuller discussion of this topic.

passages [3], [4], and [5], where the term seemed to denote an inquiry or report of factual information, similar to our “history,” but also fits with the usage in [8], [10], and [11], where the term was used to refer to an investigation or inquiry, since the *historia* is here used to facilitate demonstrations, and thus plays a role in our coming to know why certain facts are the case. Thus a *historia*, as used here, occupies a stage in an investigation, one dedicated to collecting and arranging data for the purposes of constructing demonstrations.

This is the use the term *historia* that appears to be in play in the following important methodological passage from *HA* itself.

[13] So then, these things have now been said in this way as an outline – for the sake of a taste of which things and how many things must be studied. We shall speak later with precision, in order that we should first grasp the existing differences and features/attributes for all. After this we must attempt to discover the causes of them. For this is the natural way to conduct a study, there being a *historia* about each; for about which things and from which things demonstration must be comes to be clear from these things. (*HA* I.6, 491a7-14)

491a7 Ταῦτα μὲν οὖν τοῦτον τὸν τρόπον εἴρηται νῦν ὥς ἐν
τύπῳ, γεύματος χάριν περὶ ὅσων καὶ ὅσα θεωρητέον· δι’
ἀκριβείας δ’ ὕστερον ἐροῦμεν, ἵνα πρῶτον τὰς ὑπαρχούσας
a10 διαφορὰς καὶ τὰ συμβεβηκότα πᾶσι λαμβάνωμεν. Μετὰ δὲ
τοῦτο τὰς αἰτίας τούτων πειρατέον εὑρεῖν. Οὕτω γὰρ κατὰ φύ-
σιν ἐστὶ ποιῆσθαι τὴν μέθοδον, ὑπαρχούσης τῆς ἱστορίας τῆς

περὶ ἕκαστον· περὶ ὧν τε γὰρ καὶ ἐξ ὧν εἶναι δεῖ τὴν ἀπό-
δειξιν, ἐκ τούτων γίνεται φανερόν.

I shall have the opportunity to discuss this passage at length later in the dissertation,⁷⁴ but presently we may ask, What sense might be derived from the use of *historia* in 491a12?

Just prior to a12, Aristotle states that first we must grasp the actual differences and attributes belonging to all animals, and after this attempt to find the causes. This method of procedure is described as “the natural way to conduct an investigation.” The genitive absolute clause that follows, in a12, is difficult to interpret: what meaning should we attach to the verb *huparchousês*? Gotthelf translates the line as:

For that is the natural way to pursue such an inquiry, once one has completed a
historia concerning each of these . . .⁷⁵

According to this rendering, the natural way to pursue an inquiry is to search for the causes *after* the facts have been established in the *historia*. That is, the *historia* represents the stage of investigation dedicated to establishing certain facts regarding the subject matter under study, prior to searching for the causes.

Notice how well this interpretation agrees with the use of the term *historia* in passage [13] above from *APr*. There the claim was that a completed *historia* will aid in the construction of deductions by facilitating the identification of middle terms. Here that point of method is not

⁷⁴ See ch. 4, section 4.7, below.

⁷⁵ Gotthelf 2012b, p. 271.

made explicit, but what is clear is that there is or should be a stage of investigation that precedes the search for causes, and that presumably facilitates the discovery of them.

As will be argued at greater length below, I believe this is the correct understanding of *historia* in this context, and that this is the sense of *historia* that applies to the investigation reported in *HA*. In fact, the connection between this use of *historia* and the *HA* can be made stronger by considering the other uses of the term in the biological corpus that appear to refer to the *HA* itself.

2.2.4 Reflection on general uses of *historia*

In the passages looked at so far, the term *historia* has ranged in meaning from “story” or narrative, to something like our common notion of “history,” to “investigation” or “inquiry,” to a first stage of inquiry. These various meanings are clearly connected: a “history” is a sort of “investigation” or “inquiry,” but one that typically focuses on reporting certain facts, perhaps with an eye towards some sort of understanding that might lead to identifying the causes responsible for the reported facts, but precedes any definite attempt to determine those causes. It is this last sense of *historia* that applies best to the *historia* of animals reported in the *HA*.

2.3 SPECIFIC REFERENCES TO *HA*

Among the instances of the term *historia* in the Aristotelian corpus, a great majority of them appear to be used as references to the *HA* itself. These passages, which all appear in the biological or zoological works, typically refer the reader back to a *historia* in order to find

additional information regarding the subject matter at hand. Our question is: What can we learn about the *historia* of animals from these references? What role should we expect the *historia* to play? What should we expect to find in the *historia*? Does the *HA* meet these expectations?

A list of all these references (with Greek text and English translations) is included in Appendix A. In what follows below I will make some generalized observations on all the references, and discuss a few in particular.

There is some variability in the manner in which the passages refer to *HA*. Most typically use either the Greek preposition *en* or *ek* followed by some form of *historia peri tôn zôôn*, which mirrors the traditional title of *HA*. Of the 24 passages I studied, the majority are found either in *PA* or *GA*, and these typically point the reader back to *historiai* in order to gain additional information or clarity regarding some topic under discussion—typically a part of an animal: its form, position, etc.⁷⁶ In most cases it is possible to identify passages in *HA* that “answer” the reference in the other work, however it is not always the case that the corresponding passages in *HA* do include *more or more detailed* information.⁷⁷

In what follows below, I organize these passages as follows. First I consider the references to *HA* that characterize the *historia* as a preliminary investigation. These passages further confirm Aristotle’s “technical” use of the term, as argued above. Next I consider those references that are paired with references to the *anatōmai*—a lost work, thought to include pictures or diagrams. These passages provide some clue as to what kind of information a *historia*

⁷⁶ See Appendix A for details.

⁷⁷ In fact, Balme argues that many of the corresponding passages in *HA* contain *less* information than the other works, and often appear to be brief summaries or abbreviations of the passages in these other works. Balme argues that it is likely that Aristotle composed the *HA* *after* these other works (i.e. *PA*, *IA*, etc.) and that he began by culling the relevant information from those works and often adding to them. See Balme 1987a, pp. 12-6, and Lennox 1996 for a critical analysis of the “Balme Hypothesis.”

is meant to provide. Next I consider those passages that specifically make reference to the *historia* identifying the *differences* between the parts of animals, animals themselves, etc. These are important because they help us understand Aristotle’s comment (in passage [13] above) that the *historia* will document our grasp of the “differences and attributes” belonging to all animals.

2.3.1 *Historia* as *hoti* investigation

The first passages to consider refer to the *historia* of animals, not in order to provide additional detail to a specific argument, but rather in a more general way, contrasting the project of the *historia* with that of the investigation presently at hand.

The first such passage to consider appears in *PA* II.1:

[14] From which parts and from how many parts each of the animals is constituted has been exhibited more clearly in the *historiai* about them; it is the causes owing to which each animal has this character that must now be examined, on their own and apart from what was said in those *historiai*. (*PA* II.1, 646a9, 11)

646a8 Ἐκ τίνων μὲν οὖν μορίων καὶ πόσων συνέστηκεν ἕκαστον
τῶν ζώων, ἐν ταῖς ἱστορίαις ταῖς περὶ αὐτῶν δεδήλωται σα-
a10 φέστερον· δι’ ἧς δ’ αἰτίας ἕκαστον τοῦτον ἔχει τὸν τρόπον,
ἐπισκεπτέον νῦν, χωρίσαντας καθ’ αὐτὰ τῶν ἐν ταῖς ἱστορίαις
εἰρημένων.

In this passage Aristotle makes a distinction between two stages of investigation: a preliminary

stage dedicated to establishing certain facts regarding the parts exhibited by animals, and a later stage dedicated to determining the causes that explain why each animal possess the parts that it does, and why the parts have the character that they do. The first stage is accomplished (or reported) in the *historiai*, while the second is the business of the *PA*. This distinction appears to be the same one made in the important methodological passage in *HA* I.6 (passage [13]). The actual reference is to the *hisotriai* “about them” (*peri autôn*). The antecedent of “them” is either “the parts” (in a8), or, more likely, “the animals” (in a9). In either case, that the reference is to *HA* is reasonably secure, in so far as the first four books of *HA* may be considered a *historia* about the parts of animals.

The relationship between the two stages of investigation is made somewhat confused by the final lines of the passage, where Aristotle states that the causes must be considered “on their own and apart from what was said in those *historiai*.” Should not the *historiai* aid in the discovery of causes? Why should the discussion of causes take place “on their own” and “apart from” the *historiai*? Perhaps Aristotle’s point is that the discussion of causes represents an advance on the discussions of the *historiai*, such that what must be said of the causes is not said in the *historiai*, and thus must be said “apart from,” i.e. in addition to, what was said in the *historiai*.

This raises the question of the precise role of a *historia*. The process by which we come to know (or *should* go about coming to know) why something is the case—the stages we do or should pass through—need not be reflected precisely in the treatises that report on these stages. That is, a *historia*, which reports the facts regarding an area of study that must or should be grasped prior to search for causal explanation, need not be composed prior to the discovery of these causes, or at least the discovery of *all* the causes.

The next passage to consider appears in *IA* 1:

[15] Regarding all these things, and as many others as are similar to these, we must investigate the causes. That these things hold in this way is clear from the natural *historia*, but why they do, must now be examined. (*IA* 1, 704b8-11)

704b8 περὶ δὲ πάντων τούτων, καὶ ὅσα ἄλλα συγγενῇ τούτοις,
 τὰς αἰτίας θεωρητέον. ὅτι μὲν οὖν οὕτω ταῦτα συμ-
b10 βαίνει, δῆλον ἐκ τῆς ἱστορίας τῆς φυσικῆς, διότι δέ, νῦν
 σκεπτέον.

The facts referred to in this passage all pertain, as the entire treatise does, to aspects of animal locomotion, and include such facts as *all blooded animals move at four points, all bloodless animals move at more than four points, all animals with feet have an even number of feet, humans and birds are the only two-footed animals but bend their legs oppositely*, etc. The reference to the “natural *historia*” renders it slightly uncertain as to whether it is *HA* that is being referred to, however the extended discussion of animal locomotion in *HA* II.1 answers reasonably well to the facts described in *IA* 1.⁷⁸

In this passage, the connection with *hoti* and *dioti* forms of inquiry, discussed in *APo.* II, is especially strong, in so far as these terms are actually used in the appropriate sense in the

⁷⁸ See especially the discussion of the bending and movements of the limbs at *HA* II.1, 498a2ff.

passage itself: the *historia* establishes *that* certain facts hold, while the *IA* will explain *why* they hold.

These passages suggest that a *historia* of animals will primarily include a factual report of the features and characteristics exhibited by animals. What the passages do not address directly is the precise nature of the facts that are to be reported. In passage [14] from *PA*, the claim is that the *historia* includes information about the parts of animals, but does not specify whether this includes, for example, identifying which kinds of animals possess which parts.

2.3.2 *Historia and anatomai*

Of the passages I considered, half (12 to be precise) refer the reader back both to the *historiai* and to the *anatomai*. The *anatomai* is a lost work (or collection of works) that presumably was, or included, a number of drawings or diagrams of animals, in particular of their inner parts.⁷⁹ These passages presumably refer to both works because the subject matter under discussion can be profitably illuminated by both a detailed description in words and a visual picture or display. For example, consider this passage from *PA* III.14:

[16] The study of the way in which these parts are related to one another in position and in their form should be based on the *historia* about animals and the *anatomeis*.
(*PA* III.14, 674b16)

674b15 Ὅν δ' ἔχει τρόπον ταῦτα πρὸς ἀλλήλα τῇ

⁷⁹ Diogenes Laertius V.25: lists 8 books of *Dissections* and one *Selection from Dissections* (6 and 1 in the Vita Hesychii).

θέσει καὶ τοῖς εἶδεσιν, ἔκ τε τῆς ἱστορίας τῆς περὶ τὰ ζῷα
δεῖ θεωρεῖν, καὶ ἐκ τῶν ἀνατομῶν.

The context of this passage is a discussion of the multiple stomachs possessed by some animals. The reference back to the *historia* and the *anatomai* is to help the reader better understand the position (*thesis*) of these parts relative to one another, and their form (*eidê*). Presumably a detailed picture could well-exhibit the position of these parts relative to one another, in a manner that might more easily be grasped compared to a narrative description of the same. Similarly, the form of these parts, in so far as form includes shape, might be made clearer by a picture. But there are some aspects of a part of an animal, such as precise structural features, that might not be as readily grasped by a picture, and might better be explained in words, especially when one considers the great obstacles facing the 4th century B.C. author from producing and reproducing such pictures. Written accounts of such details would appear in the *historia*.

Of special interest are the few passages that suggest a student might learn different things from each. For example, consider this passage from *Resp.* 4:

[17] The position of the heart relative to the gills should be studied visually from the *anatomai*, and in detail by reference to the *historiai*; but to summarize for our present purpose, the facts are as follows. (*Resp.* 4, 478a34-b2)

478a34

ὥς δ' ἡ θέσις ἔχει
τῆς καρδίας πρὸς τὰ βράγχια, πρὸς μὲν τὴν ὄψιν ἐκ τῶν

περὶ τὰ ζῶα θεωρείσθω καὶ ἐκ τῶν ἀνατομῶν· τὰ μὲν γὰρ τῷ
λόγῳ τὰ δὲ πρὸς τὴν ὄψιν αὐτῶν σαφηνίζειν δεῖ μᾶλλον.

The context of this passage is a discussion of the parts of bloodless animals, specifically the *malakia*, *malakostraka*, and *ostrakoderma*. While he does not specify precisely how the different works aid in our understanding differently, he does make the point that some things are better clarified by means of an account or argument (*logos*), while others are by “visual inspection” (*pros tēn opsin*).

Our interest here is primarily in the *historiai* and what these references can teach us about them. One thing that emerges from these double references to *historiai* and *anatomai* is that the *historiai* were clearly written accounts in words, and that Aristotle believed such written accounts provided a level of *akribeia* that visual inspection could not, or could not easily, provide.⁸⁰ Rendering what is seen into words provides a level of detail that may be otherwise missed.

2.3.3 Passages that explicitly reference differences

A few of the passages considered make explicit reference to the *historia* documenting the *differences* between animals, in their parts, manners of reproduction, etc. These references are of particular interest due to the interpretive debate, discussed above, regarding the methodological passage from *HA* I.6 (passage [13] above), in which Aristotle claims that the first stage of investigation or inquiry is to grasp the “differences and attributes” that belong to all animals.

⁸⁰ See ch. 5, sections 5.1.1.3, and 5.1.1.4, for a more detailed argument for this claim.

Recall that, on the Balme/Lennox/Gotthelf reading, Aristotle recognizes little or no difference between these terms in the *HA*, while on the Charles reading, “differences” refers to something like “specific difference,” i.e. the feature or features that divide a given kind into forms, while “attribute” refers to the features that belong to those kinds and forms *per se*.

Consider, for example, the following passage from *PA* IV.8:

[18] Each of the parts – what their positions are and what differences there are from one animal to another, including in what way the males differ from the females – should be studied with the help of the dissections and the *historiai* about animals.
(*PA* IV.8, 684b5)

684b2

Καθ’

ἕκαστον δὲ τῶν μορίων, τίς ἢ θέσις αὐτῶν καὶ τίνες διαφο-
ραι πρὸς ἄλληλα, τῶν τ’ ἄλλων καὶ τίνι διαφέρει τὰ ἄρρενα

b5

τῶν θηλειῶν, ἕκ τε τῶν ἀνατομῶν θεωρεῖσθω καὶ ἐκ τῶν ἰστο-
ριῶν τῶν περὶ τὰ ζῷα.

The “parts” referred to here are primarily locomotive parts, such as feet, claws, tail, etc. The immediate discussion is of the differences of such parts in different kinds of *malakostraka*. However this passage marks a transition from a discussion of the external parts of bloodless animals to the internal parts, so the antecedent of “these parts” may be the external parts of bloodless animals, rather than those of the *malkostraka*.

The reference to the differences of these parts relative to one another (*pros allêla*)

suggests that the differences are keyed to the different kinds of animals, so that the *historia* is to include data about which kinds possess which parts. However it is not specified *how* the kinds of animals will be marked off, i.e. whether reference will be made to the proper names of specific kinds/forms, or whether e.g. animals will be grouped according to shared features. Nor is there any indication that the differences so identified will be the specific differences responsible for dividing a kind into its proper forms.

Consider next the following passage from *PA* IV.10:

[19] Both how the parts concerned with the seed and embryo are arranged internally and in what manner they differ are apparent with the help of the *historia* about animals and the dissections, and will be stated later in the works on generation.
(*PA* IV.10, 689a18)

689a17 Ἐντὸς δὲ πῶς ἔχει, καὶ πῇ διαφέρουσι τὰ
τε περὶ τὸ σπέρμα καὶ τὰ περὶ τὴν κύησιν, ἔκ τε τῆς ἱστορίας
τῆς περὶ τὰ ζῷα φανερόν καὶ τῶν ἀνατομῶν, καὶ ὕστερον
a20 λεχθήσεται ἐν τοῖς περὶ γενέσεως.

Again, similar to passage [18] above, the reference to the manner in which these parts differ pertains, presumably, to how they differ in different kinds of animals, and thus the *historia* is to include information not only about parts, but also about the kinds of animals that exhibit the parts. But again, it does not appear that these differences are the very ones responsible from dividing the kinds in question into various forms.

Finally, consider the following passage from GA III.10:

[20] To find out the various differences between each of these kinds (*tôn toioutôn genôn*), and between them and bees, the records given *peri tas historias* should be studied. (GA III.10, 761a10)

761a8

πόσας

δ' ἔχουσι διαφορὰς ἢ πρὸς ἄλληλα τῶν τοιούτων γενῶν ἕκα-
στον ἢ πρὸς τὰς μελίττας ἐκ τῶν περὶ τὰς ἱστορίας ἀναγε-
γραμμένων δεῖ θεωρεῖν.

The discussion is of the generation of hornets and wasps, and how it differs from that of bees. Thus the differences noted are again aligned with particular kinds of animals, such that the *historia* will provide information regarding which kinds of animals differ in which ways. But the differences so identified do not appear to be prioritized or used as specific differences. Rather they appear to be considered on par with the others.

These passages are important for our understanding of *historia* because they emphasize the role a *historia* plays in documenting the differences between attributes exhibited by animals, and suggest that the *historia* will in some way specify or identify the groups of animals that exhibit these differences. As I've pointed out above, it is unclear whether these groups will be identified according to a classification that grasps the animals' essential natures (as Charles's understanding of a *historia* may lead us to expect), and indeed no special emphasis appears to be

placed on the differences so identified as being the specific differences used to divide a kind into forms, and thus no indication is given that a *historia* s to play this role.

3.0 PRELIMINARY CONSIDERATIONS II: THE *ANALYTICS* AND *PARTS OF ANIMALS* I.

As discussed in chapter 1, scholars have recognized and elaborated on the relationship between the project of the *HA* and Aristotle's discussions of explanation and demonstration, especially those in the *Analytics*. Differences in the interpretation of these discussions have in turn led to difference in the interpretation of the role and function of the *HA*. Prior to turning to the *HA* itself, in this chapter I examine the relevant passages from the *Analytics* (especially *APo.* II) in an attempt to determine what we can learn from those discussions regarding the project of a *historia*.

First, I shall begin by looking at the methodological passage from *HA* I.6 for "clues" regarding the relationship between a *historia* and Aristotle's theory of explanation and demonstration. Next, I discuss Aristotle's treatment of the stages of investigation in *APo.*, and consider whether Aristotle offered any insight regarding how an investigation progresses from the early stages of establishing and organizing facts to the later stages of discovering causes and formulating causal explanations. This discussion will focus especially on *APo.* II. Finally I discuss Aristotle's extended reflections in *PA* I on the method of investigation that is most proper to the study of living things and consider what insight that discussion offers on the project of a *historia* of animals, given the picture developed throughout the chapter.

3.1 *HA* I.6, 491A7-14: METHODOLOGICAL CLUES REGARDING AIMS AND PURPOSES OF *HA*

The task of elucidating Aristotle's aims, purposes, and methodology in composing a *historia* of animals is facilitated by an important methodological reflection that appears in an early chapter of *HA*.⁸¹ The first six chapters of book one form something of an introduction to the entire treatise; a detailed examination of this portion of text appears below.⁸² For now I want to focus on a passage near the end of chapter 6, perhaps the most important methodological passage in the entire treatise. It provides the necessary "clues" to help develop Aristotle's conception of *historia*. The passage reads:

[1] So then, these things have now been said in this way as an outline – for the sake of a taste of which things and how many things must be studied. We shall speak later with precision, in order that we should first grasp the existing differences and features/attributes for all. After this we must attempt to discover the causes of them. For this is the natural way to conduct a study, there being a *historia* about each; for about which things and from which things demonstration must be comes to be clear from these things. (*HA* I.6, 491a7-14)

⁸¹ See above ch. 2, passage [13].

⁸² See below ch. 4.

491a7 Ταῦτα μὲν οὖν τοῦτον τὸν τρόπον εἴρηται νῦν ὥς ἐν
τύπῳ, γεύματος χάριν περὶ ὅσων καὶ ὅσα θεωρητέον· δι’
ἀκριβείας δ’ ὕστερον ἐροῦμεν, ἵνα πρῶτον τὰς ὑπαρχούσας
10 διαφορὰς καὶ τὰ συμβεβηκότα πᾶσι λαμβάνωμεν. Μετὰ δὲ
τοῦτο τὰς αἰτίας τούτων πειρατέον εὑρεῖν. Οὕτω γὰρ κατὰ φύ-
σιν ἐστὶ ποιεῖσθαι τὴν μέθοδον, ὑπαρχούσης τῆς ἱστορίας τῆς
περὶ ἑκάστον· περὶ ὧν τε γὰρ καὶ ἐξ ὧν εἶναι δεῖ τὴν ἀπό-
δειξιν, ἐκ τούτων γίνεται φανερόν.

A number of points are made in this passage, some of which are obscured by the use of pronouns whose antecedents are not immediately clear. What does seem clear is the following:

- HA I.1-6 is offered as an “outline” (*tupos*) meant to provide a “taste” of the things that will be discussed with greater precision later. This includes both the *content* of these chapters, and *the manner of presentation* (*touton ton tropon*, a7).
- The goal of the later, more precise discussions will be to “grasp the existing differences and attributes for all” (*tas huparchousas diaphoras kai ta sumbebêkota pasi lambanômen*), presumably all *animals*.⁸³
- After this is accomplished, there will be an attempt to discover the causes of the differences and attributes, for this is the natural way to conduct an investigation, when

⁸³ On the face of it, it is unclear whether *diaphora* and *sumbebêkota* are intended to be distinct concepts or are here used almost synonymously.

there is (or perhaps beginning with) a *historia* about each (each kind of animal? each kind of attribute?).

- This is because the “about-which-things” (*peri hôn*) and the “from-which-things” (*ex hôn*) that demonstration (*apodeixis*) must make use of are made clear from these things (i.e. from a grasp of the differences and attributes).

The passage provides important clues regarding the relationship between the *HA* and Aristotle’s philosophy of science, as it is discussed in such works as the *Analytics*, *Metaphysics*, and *Parts of Animals*. In those works, many of the terms used here (e.g. *diaphora*, *sumbebêkota*, *historia*, *apodeixis*, *aitia*, *methodos*, *peri hôn*, *ex hôn*) take on rather “technical” meanings. Their appearance in this passage suggests that the theories developed in those other works may be at work here, and investigating those discussions may shed light on what Aristotle is attempting to accomplish.⁸⁴ For example, the stages of investigation discussed in the passage (i.e. first grasp the differences and attributes present in all animals, then attempt to discover their causes) are reflected in a number of methodological asides Aristotle makes in other treatises, and are made thematic in *APo.* II; the sense in which a *historia* may provide the necessary starting point for *apodeixis* is discussed in *APr.* I.27-30;⁸⁵ the role of the *peri hôn* and *ex hôn* in *apodeixis* is

⁸⁴ One must use caution against “over-systematizing” Aristotle’s language, especially the language associated with demonstration and proof. See Lloyd’s “The theories and practices of demonstration” in Lloyd 1996 (see Lennox 2001c for a critical response). However the use of the terms here is suggestive enough to warrant investigation into the relationship between the methodology recommended here, and that discussed in the so-called “logical” works.

⁸⁵ See especially *APr.* I.30, 46a23ff.; above ch. 2, passage [12]; below ch. 6, section 6.1.

discussed in *APo.* I; the use of the term *diaphora* suggests the language of division (*diaireisis*), a topic discussed at length in both *APo.* II and *PA* I.⁸⁶

In the following sections I will pursue these methodological clues as a precursor to the discussion of the *HA* itself.

3.2 ANALYTICS AS BACKGROUND TO *HA*

3.2.1 *Hoti* knowledge in *APo.* I.13

In the methodological passage from *HA* I.6 discussed above (passage [1]), Aristotle recommends that the investigation of animals should proceed by first “grasping” the differences and attributes exhibited by all animals, and only then by attempting to discover their causes. This methodological prescription maps onto the distinction Aristotle makes between knowing *the fact* (*to hoti*) and knowing *the reason why* (*to dioti*), and is rooted in the discussions of demonstration, knowledge, and inquiry in *APo.*⁸⁷ In book I of that work we learn that *epistêmê* is achieved by possessing a demonstration that meets certain well-defined and very strict criteria—an *apodeixis*. This takes the form of a syllogistic deduction⁸⁸ whose middle term is the *aitia*, the cause, and thus the explanation of why the subject possesses the predicated attribute. It may happen that one comes to know *that* the conclusion of such a demonstration holds, without

⁸⁶ See *APo.* II.5, 13 (my discussion in section 3.2.4 below); *PA* I.2-3 (on which see especially the related discussions in Balme 1972 and Lennox 2001a).

⁸⁷ The connection between *historia* and *to hoti* is also suggested by passages in *IA* 1, *Apr.* 30, etc. See above chapter 2, section 2.3.1.

⁸⁸ Commentators disagree regarding the extent to which Aristotle’s “syllogistic” is fully at work in his account of *apodeixis* in *APo.* I. See e.g. Barnes 1981; Ferejohn 1991, part I.

knowing *why* it holds—that is, without knowing the cause. This distinction between knowing what Aristotle calls *to hoti*—“the that” or “the fact”—and knowing *to dioti*—“the why” or “the reason why”—plays a fundamental role in Aristotle’s epistemology and philosophy of science. In *APo.* Aristotle labors to show that knowing, in the fullest and most complete sense of the term, requires knowing the reason why a fact holds. One can trace these concerns back to various epistemological discussions in Plato.⁸⁹ The distinction between *to hoti* and *to dioti* shows that Aristotle’s countenances different degrees of knowing, or different cognitive states that each can count as instances of knowing, but in a delimited manner.

The distinction makes its first appearance in *APo.* I.13,⁹⁰ where Aristotle discusses various deductions that fail to meet the requirements of *apodeixis*, but are nonetheless sound. In these cases the conclusions follow from the premises, but they are not properly explained, and thus the possession of such a deduction does not produce *epistêmê* in the knower. The failure stems from the middle term not being the true cause, and thus not being properly explanatory: either the premises are not immediate (78a24ff.) such that further deductions, and thus further middle terms, are needed to arrive at the “primary cause” that explains the connection between the major and minor terms; or the middle term “converts” with one of the other terms (78a27), cause with effect, such that the deduction proceeds through the effect instead of the cause, and is thus not explanatory of the conclusion. In each of these cases a deduction is provided with true premises, such that the conclusion follows of necessity, and one can be said in some sense to

⁸⁹ See, for example, *Meno* 97e-98a (“Dedaelus’ statues”); *Gorgias* 465a (rhetoric as experience without an account of the cause), etc. See Charles 2010 and Ferejohn 2014.

⁹⁰ However in *APo.* I.8 Aristotle does make the distinction between three forms of definition, one of which is like the conclusion of a demonstration (i.e. similar to *to hoti*), and one which is like a demonstration with its terms rearranged (similar to *to dioti*). The third form is like an *archê*, i.e. an indemonstrable, un-mediated proposition. This same distinction structures the discussion in *APo.* II.10.

know that the conclusion holds based on the deduction, but since the middle term is not properly explanatory (i.e. is not the *cause* of the major term inhering in the minor) the deduction does not reveal *the reason why* the conclusion holds, but only provides *the fact that* the conclusion holds.⁹¹

APo. I.13 continues by discussing another situation in which *to hoti* is grasped without *to dioti*. This happens in the “mixed” sciences, such as optics, harmonics, and astronomy, which study mathematical features of natural objects. Here according to Aristotle *to hoti* is established by the *aisthêtikon* (“perceiver” or, as Barnes translates, “empirical scientist”) while *to dioti* is provided by the mathematician.⁹² The two sciences in question (an observationally based natural science, and mathematics) are related, as Aristotle describes, “one under the other” (*thateron hupo thateron*). In these cases mathematical regularities involving natural subjects are established through perception (e.g. all rainbows are semi-circular in shape), but the explanations of these regularities, according to Aristotle, involve mathematics alone, and thus fall under the purview of the mathematician.⁹³ The details regarding the relationship between such sciences are, for the present purposes, not as important as the distinction Aristotle draws here between establishing the fact of a certain regularity by means of perception, and then proceeding to provide its explanation. Presumably many, if not all, natural sciences proceed in a similar

⁹¹ Aristotle does not discuss how one might come to recognize that the middle term is not the cause, or that the terms are converted, etc. I believe the example he provides (of the planets twinkling because they are near, not near because they twinkle) is meant to be an obvious one, though it may not be so obvious in all cases.

⁹² See *APo.* I.13, 78b35.

⁹³ That is, the explanation of the mathematical regularity is based on other mathematical features of the natural subjects, such that there is a purely mathematical explanation of the mathematical regularity. Applying that explanation to natural phenomena requires “bridge propositions” (my phrase) that include both natural and mathematical terms that allow one to apply the mathematical demonstration to the natural subject. On this topic see McKirhan 1978, 1992; Lear 1982; Lennox 1985; Hankinson 2005, Distelzweig 2013.

manner, even if the explanations of the perceptually grounded facts are not provided by a different science. That is, natural science proceeds by first recording observed natural regularities and then searching for explanations (rather than, for example, beginning by positing certain premises and proceeding by deducing various conclusions from those premises).

Although he does not say so explicitly in I.13, one may reasonably presume that it is by induction (*epagôgê*) that the observer is able to formulate and verify these universal propositions: these are instances where perception of the particulars “make the universal clear.”⁹⁴ But it is of note that in these instances the universal that is thereby made clear is not an unmediated fact/first principle. Rather it is a fact that has an explanation, but one which is not yet known. Throughout book I of *APo*. Aristotle hints at another way of knowing something other than through demonstration, and this “principle of knowing” is later identified as *nous*, which operates in conjunction with *epagôgê*. However in those instances it is first principles that are at issue: since all knowledge cannot be demonstrative, on pain of infinite regress or circular demonstration, there must be another way of securing the ultimate premises upon which demonstrative knowledge rests.⁹⁵ The difference I wish to highlight here is only that *epagôgê* may be equally employed to establish the fact of many mediated universal propositions, prior to our grasping their causes, and indeed this seems to be the path followed in the investigation of natural things.

The methodological passage from *HA* I.6 hints at this very point in stating that the *historia* provides both the *peri hôn* and *ex hôn* of *apodeixis*, i.e. both the ultimate premises of

⁹⁴ See e.g. *APo*. I.1, 71a8.

⁹⁵ But, as Bolton has stressed (1991), even our coming to know first principles is an instance of learning through preexistent knowledge, only in this case what is known first pertains to particulars, and is delivered immediately by *aisthêsis*.

demonstration, and the conclusions that are to be demonstrated. How one differentiates between these—how one comes to know what is cause and what is effect—is not specified, and may very well fall outside of the scope of the *historia*.⁹⁶

Aristotle thus countenances a sense of knowing that exceeds mere opinion or conjecture, but falls short of knowing in the fullest sense of the term. His discussion of opinion in *APo.* I.33 makes it clear that one can be of the opinion *that* something is the case without knowing it to be so—knowing neither *that* it is the case nor *the reason why*. That chapter argues that, although opinion in one sense is directed at things or states of affairs that could be otherwise (unlike the universal propositions that are the concern of *epistêmê*), in another sense, opinion and *epistêmê* can be directed at the same things, but represent different cognitive attitudes towards those same things. Knowing the fact marks an advance over opining the fact, but still falls short of *epistêmê*, or knowing the reason why.

3.2.2 *APo.* II.1-2: *hoti/dioti, ei esit/ti esti*

The *hoti/dioti* distinction is discussed again at the beginning of *APo.* II. There Aristotle introduces four interrelated questions concerning scientific knowledge and investigation. *APo.* II.1 begins thus:

⁹⁶ See for example the *APr.* I.30 passage that similarly states that the *historia* provides the “raw materials,” as it were, to construct deductions, but says nothing about which deductions will produce *epistêmê*. But note the connection, there noted, between *emperiria* and the grasp of first principles. If it is by experience that we come to grasp first principles (perhaps *as* first principles), and if it is the case that the *historia* reports the accumulated experience of a researcher in a given field, then there may be a connection between the *historia* and the recognition of first principles as such. See ch. 6 below.

- [2] The things sought are equal in number to those we understand. We seek four things: the fact, the reason why, if something is, and what something is. (trans. Barnes, adapted)
- 89b23 Τὰ ζητούμενά ἐστιν ἴσα τὸν ἀριθμὸν ὅσαπερ ἐπιστά-
μεθα. ζητοῦμεν δὲ τέτταρα, τὸ ὅτι, τὸ διότι, εἰ ἔστι, τί
25 ἐστιν.

“The things sought” (*ta zêtoumena*) are the objects of any investigation whatever: all inquiry is directed towards one or more of the four items listed.⁹⁷ The emphasis here on *inquiry* (*zêtêsis*, *zêtein*) is important to note, since it is often argued that the *APo.* is primarily concerned not with inquiry but with the form in which knowledge that has already been obtained should be organized and/or presented.⁹⁸ While this is a primary aim of book one, book two focuses more on definitions, what they are, what role they play in demonstrations, and, importantly, *how we come to know them*. Since definitions are perhaps the most important kind of first principle employed in *apodeixis*, the question of how we come to know definitions is of primary concern to scientific investigation.

The first of the *zêtoumena*, *to hoti*, is characterized as an expression of “whether this or that is the case” (*poteron tode ê tode*, 89b25). Based on the example provided (whether the sun is eclipsed or not), *to hoti* is typically construed as a statement of fact, where a given attribute is

⁹⁷ But are these the only things that can be asked? See Barnes's note to the passage (p. 203).

⁹⁸ See Lennox 1991, pg. 41; Barnes 1993, introduction; Golden 1996, ch. 1.

predicated of a subject (e.g. whether being-eclipsed belongs to the sun). But the requirement that *epistêmê* is always of the universal indicates that an investigation of *to hoti* is not into whether this or that *particular* subject exhibits a predicate, but rather whether the *kind* of thing the subject is exhibits the attribute in question.⁹⁹ Cast in a form amenable to syllogistic analysis, *to hoti* expresses the fact that *AaB*, and to investigate *to hoti* is to inquire whether it is the case that *AaB*. Once *to hoti* is known, Aristotle states that investigation can then proceed to *to dioti*: once we know that a certain fact of the form *AaB* holds, we can then ask *why* it holds.

Is Aristotle here recommending a method of investigation, a method that he feels will best lead to positive results, or is he simply analyzing what actually takes place in an investigation? Are there instances in which one might investigate *why* a certain fact obtains prior to establishing *that* it does? Or is the emphasis meant only to highlight the importance of establishing the facts prior to investigating their causes, as if some investigators proceed too hastily in their search for causal explanation without first properly establishing the facts they seek to explain?¹⁰⁰ Although Aristotle will go on to emphasize the importance, in seeking explanations, of establishing facts related to the *hoti*-level fact that is to be explained, the point here, in *APo.* II.1-2, is the epistemic truth that it is *impossible* to know the reason why a fact holds without knowing that it does. Aristotle allows that, in some instances, one might come to know both that a fact holds and why it does simultaneously,¹⁰¹ but for Aristotle it is simply not

⁹⁹ This demand for universality puts astronomy in an awkward position, since its subject matter is not just the kind “celestial body”, but rather *this particular planet* or *these particular stars* and their corresponding motions. However, due to the *eternality* of these particulars (in Aristotle’s view), a sort of universality is thereby achieved. See *APo.* I.8 on the demonstration of propositions involving perishable vs. non-perishable things.

¹⁰⁰ Such concerns motivate many of the criticisms Aristotle levies against his predecessors. See e.g. *Resp.* 2-7, especially 471a6ff., a20ff.

¹⁰¹ E.g. *APo.* I.1, 71a16ff.

Aristotle proceeds in *APo* II.1 by presenting a second pair of linked inquiries that bears important similarities to the first. He states:

89b31 ταῦτα μὲν οὖν οὕτως, ἔνια δ' ἄλ-
 λον τρόπον ζητοῦμεν, οἷον εἰ ἔστιν ἢ μὴ ἔστι κένταυρος ἢ θεός·
 τὸ δ' εἰ ἔστιν ἢ μὴ ἀπλῶς λέγω, ἀλλ' οὐκ εἰ λευκὸς ἢ μὴ.
 γνόντες δὲ ὅτι ἔστι, τί ἔστι ζητοῦμεν, οἷον τί οὖν ἔστι θεός, ἢ
 35 τί ἔστιν ἄνθρωπος;

¹⁰² See *APo.* I.1, 71a17-24.

Aristotle we seek the answers to these questions “in another way” (*allon tropon*), but as we shall see presently, the two pairs of investigations are closely related.

In seeking *to ei esti*, Aristotle states we seek to know whether something is or is not simply (*haplôs*). This is contrasted with seeking whether that thing “is white or not,” in other words whether it is *tode ê tode*, which is the investigation of the fact (*to hoti*). Both *to ei esti* and *to hoti* investigate existential claims, but while *to hoti* asks whether a predication holds (whether a subject *is this or that*) *to ei esti* seeks only whether a subject *is* (whether it exists) without asking whether any attribute holds of it. Once we know that a given subject exists, Aristotle states that we then proceed to investigate *to ti esti* and ask what it is.

Aristotle’s pronouncement here may cause some confusion, in so far as it may not initially be clear how one could establish that a subject-kind exists without first knowing what it is. Something like the Meno paradox lurks in the background: how can I seek out and establish the existence of something of which I am ignorant? The difficulty is greater still when we remember that the thing whose existence is being established is not some *particular* thing (which one could e.g. point to), but rather a *universal kind*. How can we come to know that a certain distinct kind exists without knowing what that kind is? The solution, as in the *Meno*, is that one can *know* in more than one sense. In particular, one can know something about a subject, indeed enough to establish its existence as a kind, without knowing what it is *essentially*.¹⁰³ In order to

¹⁰³ Is this view expressed in the *Meno*? One formulation of Meno’s Paradox has it that one cannot inquire into what one knows, because one already knows it; and one cannot inquire into what one does not know, because one has no knowledge of the object to guide the inquiry. One way of resolving this paradox is posit that one may know *something* about the object of inquiry without knowing *everything* about it. This partial knowledge may fall short of knowing what the object of inquiry is, in the fullest sense of knowing *ti esti*, but still may suffice to guide inquiry. My suggestion here is that Aristotle is making a similar point, namely that one may have knowledge sufficient to establish *that* a kind exists without

confirm that a subject-kind exists, it is necessary to know *something* about that kind—i.e. some feature or characteristic that can be used to reliably identify instances of the kind. However this need not necessitate knowing of the kind “what it is,” in the sense of *ti esti*, especially if the answer to the *ti esti* question is the definition of the kind, i.e. an identification of the essential feature(s).

The introduction of the second pair of inquiries (*ei esti/ti esti*) begins the transition from a consideration of demonstrative knowledge of propositions, to the knowledge of definitions. In *APo.* II.2, Aristotle argues that a definition (or at least one kind of definition)¹⁰⁴ has a sort of syllogistic structure that is comparable to an apodictic demonstration. Much of *APo.* II is devoted to definitions, what they are and how we come to know them. The introduction of the *hoti/dioti* distinction in II.1 arguably serves the purpose of introducing the *ei esti/ti esti* distinction and its relationship with definition. Readers of Plato are of course well-familiar with the *ti esti* question, but Aristotle’s discussion in II.1 effectively connects the syllogistic theory of apodeictic demonstration of book I with the concerns of coming to know definitions in book II.

In *APo.* II.2 Aristotle claims that all four modes of inquiry introduced in II.1 are in effect searches for middle terms. They may be laid out as follows:¹⁰⁵

<i>to hoti</i>	Is it the case that <i>AaB</i> ?	Is there a middle term?
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knowing *what* the kind is, in the fullest sense of the term. See Lennox 2004, pp. 87*90, Charles 2010, Ferejohn 2014.

¹⁰⁴ In *APo.* II. Aristotle discusses either three or four forms of definition: (1) an account of what a name means; (2) an immediate, indemonstrable account of what something is; (3) an account that is similar to a deduction with the terms rearranged (i.e. A is B because of C); and (4) an account that is similar to the conclusion of a demonstration (i.e. just the conclusion of the demonstration in (3)). Commentators disagree on whether Aristotle actually views (1) as a legitimate form of definition.

¹⁰⁵ See the presentation of these questions in Lennox 1991 and Barnes 1993.

to ei esti Does A (or B) exist?

to dioti Why is it that AaB ? What is the middle term?

to ti esti What is A (or B)?

It is difficult to discern Aristotle's meaning in each case. Perhaps the most straightforward is *to dioti*: when we seek the explanation of why a fact of the form AaB holds, we are seeking a middle term that connects A with B and that meets the requirements of an *apodeixis*. But in what sense is *to hoti* also a search for a middle term?

If a *hoti* investigation is a search for *whether there is* a middle term that can connect the major and minor terms (as opposed to identifying what that middle term is), then the kinds of facts that are established in a *hoti* investigation are *mediated* and not *immediate* / *primitive*. That is, they are not the kind of facts that can serve as first principles in a demonstration. As discussed above, the process by which we come to know *hoti*-level facts is similar to the process by which we come to know first principles, and seems best characterized as *epagogê*. However, in the case of *hoti*-level facts, we somehow come to recognize that the proposition so established is open to further explanation.

How is it that inquiring whether a fact obtains is the same as inquiring whether there is a middle term that explains why it obtains? On Aristotle's view, all true universal predications that are not *essential* predications (i.e. are not predications of un-mediated, defining attributes) have causal explanations: if an attribute truly and universally belongs to a subject-kind but does not figure into that kind's definition, then that attribute necessarily follows from some essential attribute that belongs to the kind. Therefore, by inquiring into whether some attribute does

universally belong to a subject kind, one is simultaneously inquiring into whether there is some defining feature of the subject kind that is the cause of that attribute, and thus whether there is some middle term that explains its presence. The challenge is to identify the correct subject-kind to which the attribute in question belongs, not just universally, but *per se*. That is, it is necessary to identify the subject-kind whose very nature is responsible for the presence of the attribute in question. Since any particular thing may be correctly characterized as belonging to more than one kind (e.g. this thing here is a bronze, scalene triangle), it is necessary to determine which characterization of the thing in question identifies the kind to which the feature in question belongs *per se*.

The above considerations show that, for Aristotle, establishing that a proposition holds implies that there is some cause that explains why it holds, and thus some middle term that mediates the subject and predicate of the proposition. In order for the relation between the *hoti* and *dioti* questions to parallel that of the *ei esti* / *ti esti*, it must be the case that that an affirmative answer to the *ei esti* question implies the existence of a middle term that answers the *ti esti* question. In other words, the *hoti/dioti* relation suggests that one establishes that a certain kind exists (i.e. affirmatively answers the *ei esti* question) when one confirms that a certain attribute belongs to a certain subject, and that confirmation implies that there is some explanation as to why the subject possess the attribute. Aristotle here endorses a form of definition, discussed in more detail in *APo.* II.8-10, that mirrors a syllogistic demonstration with the terms rearranged. The demonstration:

AaB

BaC

AaC

now becomes the definition:

A is C because of B

Here the parallel to the *hoti*-level proposition that is initially established at the *ei esti* stage is “*AaC*.”

Aristotle accomplishes this by making the answer to the *ei esti* question take the form of a proposition, similar to the *hoti* case. One comes to know *that* a certain kind exists when one can confirm that a certain attribute belongs to a subject. For example, one establishes that birds exist when one determines that, e.g., there is a kind of feathered animal with wings. In this case we give the name “bird” to “feathered animal with wings,” and we proceed to search for *why* this kind of animal has feathers and wings. The answer to that question provides the essence of the kind (i.e. *to ti esti*). Thus the recognition of the existence of the kind in question (i.e. an affirmative answer to the *ei esti* question) does not require one to know the essence of the kind. Indeed, if these represents stages that one must (or should) proceed through when investigating, then the essence of things will generally *not* be known prior to establishing the existence of those things. This is perhaps not surprising, that the essence of a thing is not revealed initially. Rather the identification of a thing *as the kind of thing that is in question* (e.g. the identification of that animal there *as a bird*) does not immediately reveal *what it is to be a bird* in the most strict and primary sense. Instead we are provided with some other, perhaps more rudimentary way of

identifying a kind, which, though sufficient for mere identification, does not reveal just what that kind is, and in fact is *explained by* what it is to be the thing.

3.2.3 *APo.* II.8-10: discovering causes

Aristotle's discussions in *APo.* II.8-10 confirm that knowing whether/if a kind exists (i.e. answering the *ei esti* question) involves establishing that a certain attribute belongs to a subject. Aristotle describes a process whereby an investigator moves from "grasping something of what a thing is" (*echontes ti autou tou pragmatos*, 93a22) to knowing fully what it is by first recognizing that the subject-kind in question is a member of a higher-level kind, and that it exhibits a *differentia* that uniquely distinguishes it from other members of the higher-level kind. The possession of that *differentia* is then explained by reference to some other, more fundamental attribute, which answers the *ti esti* question. Four examples are provided:

- (i) Thunder is a sort of noise in the clouds (*psophos tis nephôn*)
- (ii) Eclipse is a sort of privation of light (*sterêsis tis phôtos*)
- (iii) Man is a sort of animal (*zôon ti*)
- (iv) Soul is something that moves itself (*auoto hauto kinoun*)

The examples do not make the subject-attribute form of the predication obvious in each case, but if the indefinite article *tis* in the first three examples is interpreted as having some specific, though unspecified, meaning or value, then the predications would be:

- (i) Thunder = Sub(clouds), Attrbt(noise of *this* sort)

- (ii) Eclipse = Sub(Moon), Attrbt(privation of light of *this* sort)
- (iii) Human = Sub(animal), Attrbt(of *this* sort)

For example (i), the explanation that is subsequently offered (that it is the extinction of fire in the clouds that causes the noise we call thunder) allows for the following syllogism:

(*this* sort of noise) is produced by (extinction of fire)

(extinction of fire) occasionally occurs (in the clouds)

(this sort of noise) occasionally occurs (in the clouds)

And this, Aristotle says, is what thunder is: the occasional certain sort of noise in the clouds due to the extinction of fire in the clouds.

Aristotle elaborates on example (ii) in the context of knowing the fact versus the reason why (*APo.* II.8, 93a35ff.).¹⁰⁶ He describes the sort of privation of light that is the eclipse (i.e. the precise meaning of the indefinite article *tis*) in the following way: “not being able to produce a shadow during full moon although nothing visible is between us and it.” The “it” here is understood as the moon. The example is contrived,¹⁰⁷ but what’s clear is that he is describing the

¹⁰⁶ See also *Metaph.* H.4, 1044b10ff.

¹⁰⁷ I initially thought that Aristotle favors this example because it involves a “middle term” in two senses (as Sachs points out in his 1999, p. 162 n11), Lennox notes that the example has other, more serious merits, that make it valuable. In *APo.* I.8 it serves the purpose of showing how demonstration as he defines it can deal with “occasional occurrences”; in *Metaph.* H.4 it is an example of a natural occurrence that does not have a final cause; in *APo.* II.8-10 it serves as a case where you can have explanatory middles that are more and less primary; he can use it as an example where, if you were situated differently than we are, you could actually SEE the cause, and so on. Plus it, like thunder, displays easily the idea that a definition is a reworded demonstration.

precise sort of privation of light he is referring to for the definition of an eclipse: when just this sort of privation of light belongs to the moon, we have an eclipse (i.e. we *call it* an eclipse). The explanatory syllogism is as follows:

(Moon) (Earth between Moon and Sun)

(Earth between Moon and Sun) produces (*this sort of privation of light*)

(Moon) undergoes (*this sort of privation of light*)

Regarding example (iii), the discussions in II.8-10 do not specify precisely what sort of animal Aristotle believes a human is (e.g. featherless biped), nor what the explanatory middle term would be, thus we cannot reconstruct what the explanatory syllogism Aristotle has in mind would look like.¹⁰⁸ What is clear, however, as in the other cases, is that the process of defining what a human is begins with identifying some unique feature that only human animals possess. When we can confirm *that* there is in fact a kind of animal *of this sort* (whatever *this sort* may be), then we are secure in the knowledge that the kind *human* exists, because by convention we have agreed to call *this sort of animal* “human,” just as we call *this sort of noise in the clouds* “thunder,” and *this sort of privation of light of the Moon* “eclipse.”

The final example (iv) regarding soul is more difficult to analyze in this way. Presumably soul is a form of the higher kind that embraces “things that move themselves,” but we are not

¹⁰⁸ *Metaph. Z.17* discusses this very issue and argues that asking what a human being is is the same as asking “why a human being is a certain sort of animal” (*dia ti anthropos esti zôon toiondi*, 1041a21), though there too Aristotle does not put forward a possible middle term.

told what kind of thing that moves itself soul is, nor is there even an indefinite article provided, such that we would have *this sort of thing that moves itself*.

The importance of this discussion, relative to our interest in *historia*, is the relationship between *to hoti* and *to ei esti* questions: both involve establishing a predication. The difference is that, in the case of *to ei esti*, the predication so established is taken to be the definition (or a part of the definition) of a third term. The definition is “completed” (or a different form of definition is achieved) when the cause of the predication established in *to ei esti* is discovered. This parallels the movement from *to hoti* to *to dioti*. Aristotle provides no real guidance in these chapters regarding how one should go about discovering such causes, nor does he indicate how the initial *ei esti* predications are themselves secured (the sense is that they are derived from repeated perceptions, as discussed above in reference to I.13). Rather his interest in these chapters is more in setting forth the notion of a quasi-syllogistic (and *apodeictic*) form of definition.

3.2.4 *APo.* II.13: “hunting” for essential attributes

A question one might ask, following the discussions of II.8-10, is how one comes to recognize the predication established at the *ei esti* stage is one that can serve as a definition.¹⁰⁹ There may be predicates that uniquely pick out forms of a higher kind that do not figure into the definition of those forms (but rather follow from them). In short, how does the investigator come

¹⁰⁹ That is, if one subscribes to the model of definition that is like a demonstration with its terms rearranged, then the attribute predicated of the subject in the “conclusion” (i.e. what the is shown to hold of the subject) figures into the definition of the subject. Presumably not all attributes that can be demonstrated to hold of the subject figure into the subject’s definition. Rather (on one reading at least) only certain attributes properly differentiate a higher kind (i.e. the subject) into lower forms.

to recognize a *differentia* as being a truly definitional one, one that differentiates a kind into proper forms? This question appears to motivate the discussion in II.13. Aristotle begins that chapter with the following passage:

[4] So then, how the *ti esti* is displayed in the terms, and in what manner there is or is not demonstration or definition of it has been said earlier; but how one must hunt for the predicates/items (*ta katêgoroumena*) in the *ti esti*, we must now speak.

96a20 Πῶς μὲν οὖν τὸ τί ἐστὶν εἰς τοὺς ὅρους ἀποδίδεται, καὶ
 τίνα τρόπον ἀπόδειξις ἢ ὁρισμὸς ἔστιν αὐτοῦ ἢ οὐκ ἔστιν, εἴρη-
 ται πρότερον· πῶς δὲ δεῖ θηρεύειν τὰ ἐν τῷ τί ἐστὶ κατη-
 γορούμενα, νῦν λέγωμεν. (96a20-3)

The first part of the passage makes reference to the discussions of definition and demonstration in II.1-10. The second clause states that the following discussion in II.13 will focus on how one determines, or “hunts out” (*thêreuein*), the actual items that appear in a given definition.

The chapter that follows, which, broadly speaking, focuses on division, is exceedingly difficult, and it is not always clear how the various subsections pertain to the whole. The first procedure discussed (96a24-b15) involves identifying a number of attributes that belong to the subject that is to be defined, but “extend further than it without going outside of its kind” (96a25), i.e. belong to other subjects that are different in form than the subject in question, but the same in kind. The goal is to determine a set of such attributes that uniquely picks out the subject in question, such that each individual attribute of the set extends further than the subject,

but the set taken as a whole does not extend further. This, Aristotle claims, will be the essence (*ousia*) of the subject in question.

On the face of it, this procedure does seem relevant to the question we were left with from II.8-10. It involves identifying the higher kind to which the subject in question belongs, and then picking out attributes that uniquely differentiate the subject in question from other forms of the kind. But commentators have been quick to recognize the difficulty with this procedure, especially with the claim that the set of attributes so identified figures into the *ousia* of the kind in question.¹¹⁰ Nothing in the procedure appears to justify the claim. The key, according to some commentators, is in the ordering procedure that Aristotle appears to emphasize in the selection of the attributes. In selecting the attributes that extend beyond the subject in question but not beyond the kind, Aristotle states:

[5] We should take items of this type *up to the point* at which we have *first* taken just so many that, while each extends further, all of them together do not extend further: this must be the essence of the object. (*APo.* II.13, 96a32-5)

96a32 τὰ δὲ τοιαῦτα ληπτέον μέχρι τούτου, ἕως
τοσαῦτα ληφθῆναι πρῶτον ὥν ἕκαστον μὲν ἐπὶ πλέον ὑπάρξει,

¹¹⁰ For example Barnes (p. 241) notes that there may be more than one set of such attributes, in which case it would not be clear which identifies the *ousia* of the kind (or indeed whether both or neither do). McKirhan (1992, 99. 113-5) describes the method discussed in the passage as “an aberration of Aristotle’s usual view” and sets it aside. Charles points out (2000, p. 225) that the definition so arrived at will not necessarily correspond to the explanation invoking form of definition discussed in II.8-10. That II.13 discusses a different form of definition than II.8-10 is defended by Ross, Barnes, and McKirhan.

ἅπαντα δὲ μὴ ἐπὶ πλέον· ταύτην γὰρ ἀνάγκη οὐσίαν εἶναι
a35 τοῦ πράγματος.

Both Barnes and Charles interpret the passage as suggesting that there is an order according to which the attributes must be selected. Barnes ventures that the ordering procedure is based on subsumption,¹¹¹ but cannot see how this helps Aristotle's case, while Charles sees something more sophisticated at work.¹¹² He notes that in the example Aristotle provides—that a triple is a number that is odd, prime, and prime *in this sense*¹¹³—the order of the attributes listed corresponds to the order found in Euclid's definitions of the attributes of numbers. This is relevant, Charles argues, because the first attribute listed (odd) is used in the procedure to determine the later attribute (prime in one sense), which in turn can be used to determine the next (prime in the other sense). That is, beyond mere subsumption, the order of attributes listed in the example corresponds to a procedure for deriving the later attributes from the earlier. This, Charles argues, constitutes a “non-ad hoc” procedure for selecting differentiae that generate genus-species divisions that capture essential features of the kinds in question, without necessarily revealing the causal features that explain the possession of the differentiae. In other words, such a non-ad hoc procedure provides a means for grasping the attributes that correctly mark-off forms from higher level kinds in just the manner desiderated by the discussions of definition in II.8-10, and produce the genus-species divisions that will later be made use of in

¹¹¹ And with some reason, as Aristotle goes on to discuss (96b25-97a6) the importance of ordering the attributes selected in a branching tree of divisions such that each “cut” embraces all the forms of the kind and leaves none out.

¹¹² See Charles 2000, pp. 222-230 for his difficult discussion of the equally difficult passage.

¹¹³ That is, neither the sum nor the product of two integers, where 1 is not an integer. There is some ambiguity whether Aristotle intends to refer to two forms of being prime, or whether he is specifying “prime in this sense” as a gloss on “prime.”

II.14 (as will be discussed below). Since such procedures are derived from the very practices of definition and explanation that are unique to the various sciences, little can be said regarding the specifics of how such procedures operate, given the level of generality at which *APo* operates. Each science will present its own unique procedures for generating genus-species divisions, but the generation of such divisions will not be random or “ad hoc.”

The importance of Charles’s interpretation of this chapter will be explored in more detail later. In short, Charles sees such a procedure for marking-off kinds at work in the *HA* (especially in *HA* I.1-5), and thus he sees as an important aim of *HA* the correct identification of animal kinds by means of identifying differentiae which correctly divide kinds into forms.

Before leaving II.13, it will be important for the considerations below to discuss a passage that appears near the end of the chapter (97b7-25). Here Aristotle provides advice regarding how to zero-in on the definition of a kind given a number of different members of the kind. The advice is as follows:

[6] You should look at items which are similar and undifferentiated, and first seek what they all have in common. Then do the same again for other items which are in the same kind as the first group and are of the same form as one another but of a different form from the first group. When you have got what all these have in common, you must do the same for remaining groups (inquiring next whether the items you have taken have anything in common) until you come to a single account: this will be the definition of the object. If you arrive not at a single account but at two or more, then plainly what you are seeking is not one item but several.

96b7 Ζητεῖν δὲ δεῖ ἐπιβλέποντα ἐπὶ τὰ ὅμοια καὶ ἀδιά-
 φορα, πρῶτον τί ἅπαντα ταῦτόν ἔχουσιν, εἴτα πάλιν ἐφ’
 ἑτέροις, ἃ ἐν ταύτῳ μὲν γένει ἐκείνοις, εἰσὶ δὲ αὐτοῖς μὲν
 b10 ταῦτα τῷ εἶδει, ἐκείνων δ’ ἕτερα. ὅταν δ’ ἐπὶ τούτων λη-
 φθῇ τί πάντα ταυτόν, καὶ ἐπὶ τῶν ἄλλων ὁμοίως, ἐπὶ τῶν
 εἰλημμένων πάλιν σκοπεῖν εἰ ταυτόν, ἕως ἄν εἰς ἓνα ἔλθῃ
 λόγον· οὗτος γὰρ ἔσται τοῦ πράγματος ὁρισμός. ἐὰν δὲ μὴ
 βαδίζῃ εἰς ἓνα ἀλλ’ εἰς δύο ἢ πλείους, δῆλον ὅτι οὐκ ἄν εἴη
 b15 ἓν τι εἶναι τὸ ζητούμενον, ἀλλὰ πλείω.

The advice appears to amount to grouping instances of the kind into like groups (i.e. forms of the kind) and seeking common attributes amongst these groups, until a single set of attributes is identified that is shared by all members of the kind. This, Aristotle claims, will be the definition of the kind. And, importantly, if no such set of common attributes is found, then he claims that one is actually not dealing with a single kind, but more than one kind.

Aristotle provides an example of a case where no common attribute is found, and thus more than one kind is at issue. The example is of pride (*megalopsuchia*):

[7] I mean, e.g., that if we were seeking what pride is, we should inquire, in the case of some prideful men we know, what one feature they have in common as such. E.g. if Alcibiades, Achilles, and Ajax are proud men, what one feature do they all have in common? Intolerance to insult—one made war, one waxed wroth, one

killed himself. Next, take some others, e.g. Lysander and Socrates. If their common feature is being indifferent to good and bad fortune, I take these two items and inquire what indifference to fortune and not brooking dishonor have in common. If they have nothing in common, then there will be two forms of pride.

97b15

οἷον λέγω, εἰ τί

ἐστὶ μεγαλοψυχία ζητοῖμεν, σκεπτέον ἐπὶ τινων μεγαλο-

ψύχων, οὓς ἴσμεν, τί ἔχουσιν ἐν πάντες ἢ τοιοῦτοι. οἷον εἰ

Ἀλκιβιάδης μεγαλόψυχος ἢ ὁ Ἀχιλλεὺς καὶ ὁ Αἴας, τί

ἐν ᾗπαντες; τὸ μὴ ἀνέχεσθαι ὑβριζόμενοι· ὁ μὲν γὰρ ἐπο-

b20

λέμησεν, ὁ δ' ἐμήνισεν, ὁ δ' ἀπέκτεινεν ἑαυτόν. πάλιν ἐφ'

ἐτέρων, οἷον Λυσάνδρου ἢ Σωκράτους. εἰ δὴ τὸ ἀδιάφοροι εἶ-

ναι εὐτυχοῦντες καὶ ἀτυχοῦντες, ταῦτα δύο λαβὼν σκοπῶ

τί τὸ αὐτὸ ἔχουσιν ἢ τε ἀπάθεια ἢ περὶ τὰς τύχας καὶ

ἢ μὴ ὑπομονὴ ἀτιμαζομένων. εἰ δὲ μηδέν, δύο εἶδη ἂν εἴη

τῆς μεγαλοψυχίας.

These comments introduce an important wrinkle to Aristotle's preferred method of investigation. Generally, when seeking the cause of a given attribute, he will recommend grouping together the various subjects that exhibit the attribute, and searching for other shared features that may either serve as the cause of the attribute in question, or help point to an underlying common cause. However, the above considerations suggest that what we commonly perceive as similar instances of a given attribute (e.g. instances of pride) may in fact have different underlying causes (e.g.

intolerance to insult, indifference to fortune), causes that themselves share no common cause.¹¹⁴

In these cases, Aristotle here says that the attribute that was initially perceived to be the same in all cases is actually different in form, as revealed by the different causal basis. This brings into question whether grouping instances of a given attribute as a guide to causal research will be fruitful, as the instances so grouped may in fact not have the same causal basis. It also brings into question whether such attributes that are differently caused are in fact the same or different,¹¹⁵ a question that is addressed explicitly in II.15-18, and discussed further below.

3.2.5 *APo.* II.14: coming to grips with problems

In II.14 Aristotle considers how we “come to grips with problems” (*to echein ta problēmata*). Following Lennox¹¹⁶ and others, I understand a “problem” as a *hoti*-level proposition whose causal demonstration is sought.¹¹⁷

¹¹⁴ Are the features picked out here meant to be *causes* of pride, or simply attributes that these various prideful men share? Passage [7] begins by asking what pride is, and the apparently favored model of definition arising from II.2, 8-10 is one that includes the cause. Thus I take in the example Aristotle is claiming that the various men are prideful *because* they do not tolerate insult, or they are indifferent to fortune.

¹¹⁵ One might argue that such differently caused attributes are themselves different, since what appears to be Aristotle’s favored model of definition includes the cause of the differentiating feature. Note however, in passage [7] above on pride, Aristotle states that the failure to find a common cause in all cases indicates that there are two “forms” (*eidê*) of pride, which might suggest that pride is a *kind* of attribute, which itself admits of different forms. In that case one might ask whether all the prideful men identified in the passage do in fact share some higher-level feature that causes them to be proud, and whether it is the differentiation of that higher level feature that brings about the specific, different forms of pride.

¹¹⁶ See especially Lennox 1994.

The first procedure outlined in chapter 14 (98a1-13) involves using a preexisting set of divisions and listing the attributes that belong universally at each cut. For example, if one is studying animals, first list all the attributes shared by all animals, then, following the divisions, list all the attributes shared by each kind falling into the first cut/division (e.g. bird, fish, etc.), and continue in this manner through the divisions. In this way a preliminary sort of explanation¹¹⁸ can be given for why any lower level kind possesses an attribute located at a higher level of division: namely, because the lower level kind is a form of the higher level kind. In short, this first procedure involves identifying the subject in question as a member of a kind that possesses the attribute in question universally. As Lennox outlines in his 1987a and 1991, this procedure in effect locates the correct level of generality at which the explanation for a given attribute should be sought. The “data” provided by the problem is used to determine the subject-kind that possesses the attribute in question, and thus prepares for “demonstration.”

However, if the procedure is to truly provide one with “the reason why” the attribute belongs to the subject, as the passage indicates it does (*to dia ti*, 98a7), even if only in the limited, “A-type” form of demonstration, then the attribute in question must not only be universally correlated with the given cut in the divisions, but must be associated with the cut *per se*, i.e. must follow from the nature of whatever is identified at the cut. Otherwise one will not truly know *why* the attribute belongs to the subject. If the division does not capture the subject-kind to which the attribute in question belongs *per se*, then it will not result in identifying the right level of generality for apodictic demonstration. There may be other ways of forming

¹¹⁷ The problems found in the *Problēmata* are typically presented in the form “*dia ti . . . ê hoti . . .*”, which emphasizes that from the beginning problems are essentially bound up with finding causes.

¹¹⁸ What Lennox (in his 1987a) calls an “A type” explanation, and Ferejohn (1991) and McKirhan (1992) call “application explanations.” See also Ferejohn 2014, ch. 5.

divisions such that an attribute is universally associated with a given cut, but not related *per se*. In that case the divisions would not identify the subject kind whose nature is responsible for the attribute, and thus not reveal the reason why.

There are at least two ways to respond to this. First, one might simply assume that the divisions provided at the beginning of the procedure do in fact capture the essential nature of the subject in question, and the attributes correlated with the divisions do belong at each cut *per se*.¹¹⁹ This would naturally raise the question of how one comes upon such divisions and correlations, and would give the impression, shared by many scholars, that the *APo.* is focused more on formalizing the presentation of knowledge already acquired, rather than on the discovery of new knowledge. Or, one might read the *dia ti* in 98a7 in a more deflationary manner, such that the sort of explanation provided by the divisions does not guarantee that the result is a problem now prepared for *apodeixis*, but rather is a step along the way towards that goal. In this case the divisions provide one with a way of locating the subject in question in a higher kind which *may* be the kind that exhibits the attribute *per se*, or may not be, but in any event provides one with a universal correlation that can guide causal research.

Aristotle proceeds by outlining a second, related procedure for dealing with problems. These are cases where “common names” have not yet been suitably assigned to the subject matter under investigation, such that a set of divisions, as used in the first procedure, is not readily at hand. Instead one begins with the attribute in question and asks what it follows and what follows it:

¹¹⁹ If I read him correctly, Charles claims that the divisions produced in II.13 answer this need.

[8] At present we argue in terms of the common names which have been handed down to us. But we should inquire not only in these cases—rather, if any other common feature has been observed to hold, we should extract it and then inquire what it follows and what follows it. E.g. having a third stomach and not having upper incisors follows having horns. Next ask what items having horns follows. It is plain why the feature in question will hold of these items: it will hold because they have horns.

98a13 Νῦν μὲν οὖν κατὰ τὰ παραδεδομένα κοινὰ ὀνόματα
λέγομεν, δεῖ δὲ μὴ μόνον ἐπὶ τούτων σκοπεῖν, ἀλλὰ καὶ
a15 ἄν ἄλλο τι ὁφθῇ ὑπάρχον κοινόν, ἐκλαμβάνοντα, εἴτα τίσι
τοῦτ' ἀκολουθεῖ καὶ ποῖα τούτῳ ἔπεται, οἷον τοῖς κέρατα
ἔχουσι τὸ ἔχειν ἐχῖνον, τὸ μὴ ἀμφώδοντ' εἶναι· πάλιν τὸ
κέρατ' ἔχειν τίσιν ἔπεται. δῆλον γὰρ διὰ τί ἐκείνοις ὑπάρ-
ξει τὸ εἰρημένον· διὰ γὰρ τὸ κέρατ' ἔχειν ὑπάρξει.

The example in the passage states that having a third stomach and not having upper incisors “follows” having horns, or in other words, all animals that have horns also have a third stomach and lack upper incisors. Aristotle next asks: from what feature does having horns follow? If we call that feature “X”, then he states it will be clear from this why (*dia ti*, 98a18) all animals that have feature X also possess a third stomach and lack upper incisors, namely because all such animals have horns. The procedure recommended is to find “common features” i.e.

features that are always correlated with a given feature under study, and to attempt to arrange them in such a manner as to show “what it follows and what follows it.”¹²⁰

But note that here too, just as in the case of the divisions in the first procedure, this second procedure will only provide causal explanations if the investigator arranges the features in such a manner that the “following” relation tracks causal responsibility. To use the example from the text, lacking upper incisors must not only follow having horns, but must in some sense *be explained* by having horns.¹²¹ It is *because* such animals have horns that they lack upper incisors. If in fact the investigator knows that having horns is in some sense responsible for the lack of upper incisors, then he may go on to ask why it is that having horns causes the animal to lack upper incisors,¹²² but that causal relationship must be established first if it is to provide the “reason why.” Similar to the first procedure, one may respond to this problem by reading the *dioti* at 98a18 in a deflationary manner, as not indicating *to dioti* in the strict sense, but rather providing grounds for believing that the indicated predication holds (i.e. *to hoti*), which can act as a preliminary guide to one’s causal research.

The third example Aristotle gives in the chapter is a sub-species of the second procedure, where an analogical unity is recognized between things that are not normally grouped together (and thus do not have a common name). Here “pounce”, “spine” and “bone” are recognized as

¹²⁰ See Lennox 1991, pp. 49-50.

¹²¹ That is, explained according either to Lennox’s A or B forms of explanation. Recall that the “A” form of explanation locates the kind to which the attribute in question belongs *per se*, while the “B” form identifies the causally relevant feature. Thus if having a third stomach is to be explained by having horns, either the kind of animal marked-off by the possession of horns must have a third stomach *per se*, or having horns is in some sense causally responsible for having a third stomach. Note that if it is the “B” form of explanation that Aristotle has in mind here, the causal relevance of having horns to having a third stomach may be further explicable (i.e. there may be a chain of causally relevant features connecting having horns with having a third stomach).

¹²² See *PA* III.2, 663b35ff.; III.14, 674a21ff.

being related in such a manner that they all share certain common attributes. By grouping them together as if they shared a common nature, the investigator may then look for other shared attributes and attempt to arrange these attributes to reveal causal relations, as suggested by the procedures above.

In summary, the method for “coming to grips with problems” that Aristotle recommends in II.14 involves establishing “follows/followed by” extensional relationships between attributes (either by using existing divisions or not) as a guide to causal research. The problem with this method, as discussed above, is that it is not clear how one comes to recognize these causal dependencies, since extension alone cannot reveal them. If it can be shown that two properties are coextensive, then there is no question that a deduction can be formed showing that, given one attribute, the other follows. But this deduction will lack the force of *apodeixis* unless it is recognized that the first attribute is the cause of the second. Based on various comments in *APo.* it’s clear that Aristotle recognizes this problem, and given his evident concern with the relationship between extension and causation (as evinced in the following chapters of *APo.* II, 16-18), I believe it’s best to read Aristotle here as describing a procedure for coming to know causes, rather than one aimed at formalizing preexistent causal knowledge, even if the procedure so described is unable, on its own, to produce the causal knowledge it aims at. That is, the method of extensional correlation will aim research in the right direction, but final judgments regarding causal relationships will ultimately rely on extra-extensional features, ones that are largely dependent upon the field of study under investigation.¹²³

¹²³ Thus Lennox (2011 and in his forthcoming book) argues for “domain specific norms” of investigation. I argue for something similar in ch. 6 below, where I discuss the manner in which *empeiria* of a given subject area plays into the identification of first principles.

Charles claims that the procedure outlined in II.13 is the one Aristotle has in mind for laying out the genus-species divisions used in II.14. In other words, the “non-ad hoc” procedure for differentiating genera into species will allow us to identify differentiating attributes that correctly mark off forms of given kinds. Additional observation will then allow us to correlate other attributes with the forms so differentiated, thus identifying the kinds/forms to which the attributes belong *per se*. Charles argues, in summary, that this is the goal of the *historia*:

Historiai are, thus, essential first steps towards causal explanation, and ones which involve determining which genera and species, in reality, differ from each other . . . and which properties genuinely belong to each kind or sub-kind.¹²⁴

3.2.6 *APo.* II.16-17: coextension of cause and effect

In these chapters Aristotle grapples with the question whether cause and effect are, in all cases, coextensive, such that the presence of a cause always implies its effect, and vice versa.¹²⁵

II.16 begins as follows:

[9] Of the cause and what is caused, one might wonder whether when that which is caused is the case, the cause also holds (just as if [a plant] sheds its leaves or if there is an eclipse, the cause of the eclipse or of the shedding also will be; for example if this is having broad leaves or (for the eclipse) the earth’s being in the middle. For if it does not hold, then something else will be the cause of them).

¹²⁴ Charles 2000, p. 316.

¹²⁵ On these chapters, see Lennox 2013.

And if the cause holds, does that which is caused also hold at the same time? E.g. if the earth is in the middle, there is an eclipse; or if [a plant] is broad-leaved, it sheds its leaves.

- 98a35 Περὶ δ' αἰτίου καὶ οὗ αἴτιον ἀπορήσειε μὲν ἂν τις,
ἄρα ὅτε ὑπάρχει τὸ αἰτιατόν, καὶ τὸ αἴτιον ὑπάρχει (ὥσ-
περ εἰ φυλλορροεῖ ἢ ἐκλείπει, καὶ τὸ αἴτιον τοῦ ἐκλείπειν
ἢ φυλλορροεῖν ἔσται· οἷον εἰ τοῦτ' ἔστι τὸ πλατέα ἔχειν τὰ
98b1 φύλλα, τοῦ δ' ἐκλείπειν τὸ τὴν γῆν ἐν μέσῳ εἶναι· εἰ γὰρ
μὴ ὑπάρχει, ἄλλο τι ἔσται τὸ αἴτιον αὐτῶν), εἴ τε τὸ αἴτιον
ὑπάρχει, ἅμα καὶ τὸ αἰτιατόν (οἷον εἰ ἐν μέσῳ ἢ γῆ, ἐκ-
λείπει, ἢ εἰ πλατύφυλλον, φυλλορροεῖ).

The question is of particular importance for Aristotle, since the method of investigation he recommends involves looking to coextensive correlations between attributes as a guide to causal research. This method would appear to be fruitful only if coextension of cause and effect holds. Aristotle points out (at II.16, 96b16ff.), as he did in I.13, that if cause and effect are coextensive, then one can construct deductions using either the cause or the effect as a middle term, such that one can be deduced from the other. But only deductions through the cause are productive of *epistêmê* (at least in the unqualified sense), providing the reason why rather than the fact. He thus recognizes, and emphasizes, that coextension alone cannot reveal causal priority, but nonetheless it may act as a guide to causal research.

II.16 ends aporetically with the question whether the same effect can have different causes, such that the possession of an attribute by one subject-kind is explained by one cause, and the possession of the same attribute by a different subject-kind is explained by a different cause. He suggests two options: (i) the same thing may be caused by different things, such that the presence of the effect need not imply the presence of a particular cause, but only of some cause (98b25ff.), or (ii) an attribute is possessed universally and *per se* by only one subject-kind, such that if more than one kind of thing appears to possess the attribute, then they are necessarily forms of the same kind, such that one cause explains the presence of the attribute for both (98b32ff.).

The aporia is taken up in II.17, where Aristotle's conclusion appears to be that an attribute can have only one cause relative to a given kind, such that all forms of the kind that exhibit the attribute do so for the same reason. He illustrates the point with the leaf-shedding example: the shedding of leaves may extend beyond e.g. vines and figs, but if we take the group of plants marked off by the feature of shedding leaves and treat it as a single kind, then a single cause (e.g. coagulation of sap) will apply to this "kind," and thus to each of the individual forms of the kind. If this is Aristotle's view, then he does hold that cause and effect are coextensive, when considered at the right level of generality.

However Aristotle appears to make an allowance that the same attribute may be present in *different* kinds, and may be due to different causes in the different kinds. He concludes II.17¹²⁶ with the following comments:

¹²⁶ The passage that immediately precedes this conclusion (99a30-b2) offers a "schematic" example that is meant to illustrate Aristotle's view, however its interpretation has been debated, and it is unclear whether the example is meant to illustrate the view that cause and effect are always coextensive, or whether they may not be when the effect appears in

[10] Then it is possible that many things are the cause of the same thing, but not for things the same in form, for example, [the cause] of long-life with respect to quadrupeds is not having bile, but for birds is the dry or something else.

99b4 ἐνδέχεται δὴ τοῦ αὐτοῦ πλείω αἷτια εἶναι, ἀλλ' οὐ τοῖς αὐ-
τοῖς τῷ εἶδει, οἷον τοῦ μακρόβια εἶναι τὰ μὲν τετράποδα
τὸ μὴ ἔχειν χολήν, τὰ δὲ πτηνὰ τὸ ξηρὰ εἶναι ἢ ἕτερόν
τι.

The suggestion here is that the same attribute (long-life) is present in four-footed animals and birds due to different causes, and this is explained by the fact that four-footed animals and birds are different in form, and thus may possess differently caused attributes.

This is problematic, in so far as Aristotle's recommended method of investigation is to group together the different subjects that exhibit a given feature and search for other common attributes that might act as a guide to causal research. If the same attribute may be due to different causes in different subjects, then this method may very well lead one astray, or at least to a dead end. The stipulation that the same forms of things will exhibit the same causes is itself problematic, as the form/kind distinction, at least as it is used in the biology, does not indicate a fixed classification system, such that two animals may be the same in form in one sense but different in another. Using the example Aristotle gives, *bird* and *four-footed* may indicate

different kinds/forms of things. See Appendix B for (the beginning) of my analysis of this passage.

different forms of the higher kind *animal*, but both are e.g. *blooded*, and thus the same in form in that respect. The discussion of pride in passage [7] is relevant here. In that passage Aristotle recommended looking for common features amongst all prideful men in order to discover the cause of pride and, upon finding none, suggested that perhaps two separate, differently caused, forms of pride were at work. Here the suggestion is not that the birds and the four-footed animals exhibit different forms of long-life, but rather that the same attribute is differently caused among the different kinds of animals. However the method of procedure is the same: if no common cause can be isolated among the group of animals that exhibit long-life, then one should attempt to divide the larger group into sub-groups that do share relevant features that may differently explain their long-life. The take-away from the example, then, is that co-extension can still be used as a tool for causal research, even in cases where the initially isolated group fails to share a feature that is coextensional with the attribute under investigation.

3.2.7 Reflection

The picture of scientific investigation that emerges from these chapters of the *Analytics* involves first establishing *that* certain regularities exist among a set of subjects and attributes, typically by means of induction via perception; second identifying correlations among the predications established in the first set, with the aim of establishing “follows/followed by” relations among the subjects and attributes; and third using those correlations as a guide to determining causes by either examining the deductions that the established predications allow for in an attempt to determine whether the middle terms so identified meet the criteria for *apodeixis*, or by using the correlations as a clue to a possible underlying common cause. In either case, the extensional correlations formed in the first steps will not alone reveal causal dependencies, but

rather additional considerations regarding what it means to be a cause in the given field of study will need to be brought to bear on the problems at hand. As these additional considerations will likely be domain-specific, little can be said in *APo.* regarding just how the causes will be determined in the various fields, given the level of generality at which the *APo.* operates.

For the field of zoology/biology, Aristotle provides as extended reflection of just these sort of causal considerations in the first book of *Parts of Animals*. In the following sections I briefly review the main questions that structure the discussion of *PA I*, and consider their relevance to the project of a *historia*.

3.3 PA I: ARISTOTLE'S PHILOSOPHY OF BIOLOGY/ZOOLOGY

The first book of *PA*, sometimes referred to as Aristotle's "philosophy of biology," consists in an extended reflection on the manner of investigation and demonstration proper to the study of animals. Aristotle begins *PA I.1* with a brief discussion of the difference between being knowledgeable in a specific field or area of knowledge, and possessing a sort of "educatedness" (*paideian*, 639a5) such that one may judge whether a given argument is well-formed, without having detailed knowledge of the specifics of the argument.

The structure of *PA I* is built around three guiding questions, introduced early in the first chapter. These questions are:

- (1) Should the investigation of animals begin with the study of individual *ousiai*,
or with a study of the attributes common to many animals?

(2) Should one begin by studying the phenomena associated with animals prior to searching for their causes?

(3) Which/what sort of cause is primary in natural things?

Each question is relevant to the present consideration of *historia*, especially the first two. In what follows I shall discuss Aristotle's response to each question and how it pertains to the project of a *historia* of animals.

3.3.1 Individual *ousiai* or attributes?

The first question regarding the "inquiry about nature" (*tês peri phusin historias*, 639a13) that Aristotle considers is presented as follows:

[11] I mean, for example, should one take each substantial being singly and define it independently, e.g. taking up one by one the nature of mankind, lion, ox, and any other animal as well; or should one first establish, according to something common, the attributes common to all? For many of the same attributes are present in many different kinds of animals, e.g. sleep, respiration, growth, deterioration, death, and in addition any remaining affections and dispositions such as these. (I add this because at the moment it is permissible to speak unclearly and indefinitely about these things.) It is apparent that, especially when speaking one by one, we shall repeatedly say the same things about many kinds; for instance, each of the attributes just mentioned belong to horses, dogs, and human beings. So if one speaks of their attributes one by one, it will be necessary

to speak repeatedly about the same things—whenever, that is, the same things are present in different forms of animal, yet themselves have no difference.

- 639a15 Λέγω δ' οἷον πότερον δεῖ λαμβάνοντας
μίαν ἐκάστην οὐσίαν περὶ ταύτης διορίζειν καθ' αὐτήν, οἷον
περὶ ἀνθρώπου φύσεως ἢ λέοντος ἢ βοῶς ἢ καὶ τινος ἄλλου
καθ' ἕκαστον προχειριζομένους, ἢ τὰ κοινῇ συμβεβηκότα πᾶσι
κατὰ τι κοινὸν ὑποθεμένους. Πολλὰ γὰρ ὑπάρχει ταῦτά
a20 πολλοῖς γένεσιν ἑτέροις οὖσιν ἀλλήλων, οἷον ὕπνος, ἀναπνοή,
αὔξησις, φθίσις, θάνατος, καὶ πρὸς τούτοις ὅσα τοιαῦτα τῶν
λειπομένων παθῶν τε καὶ διαθέσεων· ἄδηλον γὰρ καὶ ἀδιό-
ριστόν ἐστι λέγειν νῦν περὶ τούτων. Φανερόν δ' ὅτι καὶ κατὰ
μέρος μὲν λέγοντες περὶ πολλῶν ἐροῦμεν πολλάκις ταῦτά·
a25 καὶ γὰρ ἵπποις καὶ κυσὶ καὶ ἀνθρώποις ὑπάρχει τῶν εἰ-
ρημένων ἕκαστον, ὥστε ἐὰν καθ' ἕκαστον τῶν συμβεβηκότων
λέγη τις, πολλάκις ἀναγκασθήσεται περὶ τῶν αὐτῶν λέ-
γειν, ὅσα ταῦτά μὲν ὑπάρχει τοῖς εἶδει διαφέρουσι τῶν
ζώων, αὐτὰ δὲ μηδεμίαν ἔχει διαφοράν.

At issue for Aristotle here is whether one should focus study on individual kinds/forms of animals (the examples offered are mankind, lion, ox) or on the attributes exhibited by such animals in common, i.e. on shared attributes. The way Aristotle forms the question makes it clear

that, in either case, the focus of study is on *the attributes* exhibited by animals: whether one begins by studying individual forms or not, what one studies are attributes.

Although not argued for here, the answer hinted at is that one should begin study at the level of commonly held attributes, rather than with individual kinds/forms of animals. The reason hinted at is that there would be needless repetitive discussion of the commonly held attributes, if these attributes are in fact *the same* across kinds of animals (the examples offered are sleep, respiration, growth, deterioration, death). The sameness of the attributes, Aristotle here seems to assume, implies the sameness of their explanations.¹²⁷ If the goal of investigation is to explain why an animal possesses a given feature, and we assume that the same feature will have the same explanation, regardless of the kind of animal that exhibits it, then it would seem unnecessarily repetitive to cite the explanation again and again for each animal, rather than just once for all.

The upshot of the question for the *historia* of animals is clear: if the explanation of an attribute applies to all animals that exhibit it, then one should find some way of grouping animals that share common attributes such that the explanation can be offered once for all.

Aristotle continues by recognizing that attributes that, at one level of generality, may be considered different, may be thought of as the same at another. He states:

[12] Yet there are probably other attributes which turn out to have the same predicate, but to differ by a difference in form, e.g. the locomotion of animals; it is apparent that locomotion is not one in form, because, flying, swimming, walking, and

¹²⁷ But note that *APo.* II.17 appears to argue that this assumption is not warranted. Interestingly, though the example in II.17 is a biological one (i.e. long-life), I do not find concern with this issue expressed in *PA I*.

crawling differ. Accordingly, the following question about how one is to carry out an examination should not be overlooked—I mean the question of whether one should study things in common according to kind first, and then later the distinctive characteristics, or whether one should study them one by one straight away.

639a29

Ἄτερα δὲ ἴσως ἐστὶν

οἷς συμβαίνει τὴν μὲν κατηγορίαν ἔχειν τὴν αὐτήν, διαφέρειν

b1

δὲ τῇ κατ' εἶδος διαφορᾷ, οἷον ἡ τῶν ζώων πορεία· οὐ γὰρ

φαίνεται μία τῷ εἶδει· διαφέρει γὰρ πτῆσις καὶ νεῦσις

καὶ βάδισις καὶ ἔρψις. Διὸ δεῖ μὴ διαλεληθέναι πῶς ἐπι-

σκεπτέον, λέγω δὲ πότερον κοινῇ κατὰ γένος πρῶτον, εἴτα

b5

ὑστερον περὶ τῶν ιδίων θεωρητέον, ἢ καθ' ἕκαστον εὐθύς.

The attribute “locomotion” has different forms, such that any animal that “locomotes” does so in a certain manner: fish swim, birds fly, etc., but all locomote. The recognition of a kind/form organization of attributes raises the question of the level of generalization or characterization at which the study of the attributes of animals should begin.

Again, if it is assumed that the same attribute (at whatever level of generality it is considered) has the same explanation, regardless of the kind of animal that exhibits it, then a sensible method of procedure would be to begin by studying attributes at the highest level of generality possible, and then proceeding by attempting to determine why an attribute that is common at one level of generality is differentiated at another.

These considerations point to two important methodological points for the *historia*. First, grouping animals according to common attributes will be a useful stage of investigation, since the same explanation will apply to all animals that exhibit the common attribute; and second, formulating a kind/form organization of the attributes themselves will aid in their explanation.¹²⁸

3.3.2 Phenomena and causes

The second question Aristotle considers is presented thusly:

[13] At present this matter has not been determined, nor has the question that will now be stated, namely, whether just as the mathematician explains the phenomena in the case of astronomy, so the natural philosopher too, having first studied the phenomena regarding the animals and the parts of each, should then state the reason why and the causes, or whether he should proceed in some other way

639b5

Nũv

γὰρ οὐ διώρισται περὶ αὐτοῦ οὐδέ γε τὸ νῦν ῥηθησόμενον, οἷον
 πότερον καθάπερ οἱ μαθηματικοὶ τὰ περὶ τὴν ἀστρολογίαν
 δεικνύουσιν, οὕτω δεῖ καὶ τὸν φυσικὸν τὰ φαινόμενα πρῶτον
 τὰ περὶ τὰ ζῷα θεωρήσαντα καὶ τὰ μέρη τὰ περὶ ἕκαστον,
 ἔπειθ' οὕτω λέγειν τὸ διὰ τί καὶ τὰς αἰτίας, ἢ ἄλλως πως.

b10

¹²⁸ On these points, see Lennox 2010c, pp. 66-9.

The methodological distinction made here between studying the “phenomena” (*ta phainomena*) and then proceeding to state the reason why (*to dioti*) maps directly onto the *hoti/dioti* distinction discussed above, and referenced in the methodological passage in *HA* I.6. Although not argued for here, the answer Aristotle endorses is clear: the phenomena should be studied prior to the reason why and the cause.

The reference to astronomy and mathematicians here is similar to that in *APr.* I.30.¹²⁹ The claim in that passage is that the mathematicians were able to discover the causes of the various motions of the heavenly bodies (i.e. the mathematical regularities that underlie the apparently irregular motions of the planets) only after “the phenomena” regarding these bodies (i.e. the precise details of these motions) were properly documented. Similarly for the study of animals, the question suggests that the precise details regarding the attributes exhibited by animals must first be documented prior to searching for their causes.¹³⁰ That this is accomplished in the *historia* is consistent with the understanding of *historia* developed thus far.

It is interesting to ask, though, what exactly would it mean to proceed otherwise? Would it mean attempting to formulate explanations prior to grasping *all* the phenomena, i.e. when only *some* of the phenomena were grasped? Is it a word of caution against beginning with general principles and attempting to deduce various conclusions without first being familiar with the facts of the world? Aristotle does not here explain what this alternative procedure might look like, but, given the extensive criticism he levies against his predecessors due to their lack of experience with natural things, it seems probable that Aristotle is here advising against

¹²⁹ See ch. 6, passage [3], and passage [12], ch. 2.

¹³⁰ See Lennox 2010c, pp. 69-70.

attempting to formulate explanations of natural phenomena prior to a comprehensive grasp of the great variety offered by nature.¹³¹

3.3.3 The priority of final causation

The final question posed in *PA* I.1 pertains to the kind of causation that is primary in natural things. Aristotle introduces the question as follows:

[14] And in addition to these question, since we seek more than one cause of natural generation, e.g. both the cause for the sake of which and the cause from which comes the origin of motion, we need also to determine, about these causes, which sort is naturally first and which second.

639b11 Πρὸς δὲ τούτοις, ἐπεὶ πλείους ὁρῶμεν αἰτίας περὶ τὴν γένεσιν
τὴν φυσικὴν, οἷον τὴν τε οὗ ἕνεκα καὶ τὴν ὅθεν ἢ ἀρχὴ τῆς
κινήσεως, διοριστέον καὶ περὶ τούτων, ποία πρώτη καὶ δευτέρα
πέφυκεν.

¹³¹ The problem here, of course, is determining what constitutes a properly “comprehensive” grasp of the phenomena? Given that Aristotle himself sometimes warns his readers that the facts pertaining to the subjects he is attempting to explain are not yet well grasped (e.g. his discussion of the reproduction of bees, *GA* III.10; celestial phenomena, *DC* II.12, *PA* I.5, etc.), it appears that meeting the standard of “grasping the phenomena” will vary depending upon the phenomena in question.

Aristotle's answer to this question is unambiguous: the cause for the sake of which is primary. Much of *PA* I.1 is dedicated to arguing for the priority of an animal's form, or the account of its being and essence, over the generative process that causes the animal to come to be (an explanatory alternative that was on the table in Aristotle's day, as it is today). As Aristotle states explicitly: "generation is for the sake of substantial being (*ousia*), rather than substantial being for the sake of generation" (640a18). In fact, Aristotle argues that a proper understanding of an animal's generation (i.e. why the steps in its generation take place in the order that they do) is achievable only through a thorough understanding of the way an animal is. Ultimately, near the end of *PA* I,¹³² Aristotle argues for the priority of *function* and *activity* over the material and formal structures of the parts of an animal's body, and even suggests that a sort of priority exists among these very functions and activities, such that some are for the sake of others, and these last form the explanatory foundation for understanding an animal's life, body, generation, etc. The picture that emerges indicates that what an animal is, in the most fundamental sense, is defined by a way of being in the world (i.e. a way of performing certain vital functions in relation to a specified environment), and this way of being requires (i.e. "conditionally necessitates") the animal to perform certain activities, which in turn require the presence of certain parts. Aristotle identifies this "way of being in the world" with the animal's soul. Thus the generative process by which the parts of an animal's body come to be is ultimately governed by the soul. There will, nonetheless, be many attributes that are possessed by animals due "material necessity," (i.e. attributes that necessarily follow, not from the animals way of being, but from the material from which the animal is "constructed"), however even these can

¹³² See *PA* I.5, 645b15ff.

ultimately be traced back to the animal's soul, which itself conditionally necessitates the material make-up of the animal's body.¹³³

The upshot for the *historia* of animals is clear: since this “way of being in the world,” as I’ve called it, has explanatory priority in the understanding of animals, therefore a rich account of these activities and manners of life will be the necessary foundation of the explanatory science of animals. In order to understand why an animal has the particular parts that it does, one must first grasp what roles the parts plays in an animal's life, and this in turn requires a grasp of the characteristic activities an animal performs in support of the vital needs shared by all living things (primarily nutrition, reproduction, and cooling of natural heat).

In summary, the priority relations Aristotle identifies in *PA* I are:

Parts

For the sake of . . .

Activities

For the sake of . . .

Activities

For the sake of . . .

Distinctive way of life

¹³³ The material make-up of an animal's body (its *krasis*) is constrained by the environment in which the animal lives. In fact it seems that some reference to the particular environment in which an animal characteristically lives is included in the account of the animal's substantial being, i.e. its soul.

What I've described as a "distinctive way of life" cannot necessarily be reduced to a set of activities. Rather, as we shall see in the next chapter's analysis of the four primary forms of differentia introduced in *HA* I, some aspects of an animal's *bios* (manner of life) are not activities themselves, but are rather characteristics of an animal that affect the manner in which certain activities are performed. The most prominent form of this type of characteristic in *HA* is that of being a *water animal* (*enudros*) or *land animal* (*chersaia/pezon*). What e.g. being a water animal entails is not a set of vital activities; rather it entails performing vital activities in particular ways: feeding, reproducing, and cooling natural heat in specific ways. These priority relations dictate the explanatory relations between different forms of differentiae. In the most obvious case, the attributes related to the parts of animals will generally be explained by the functions performed by those parts, and differences in these parts will typically be explained either by the slightly different functions they fulfill in a given animal's life, or by some other necessary feature of the animal that requires the part in question to be differentiated as it is.¹³⁴

3.3.4 Reflection

The three questions that structure the discussion of *PA* I suggest that the *historia* of animals should (i) look primarily to the attributes exhibited by animals, rather than the different kinds of animals, and should organize the attributes in kind/form divisions that isolate general and more particular instantiations of the attributes in question. The extension of these attributes (at each level of generality) to the kinds of animals that exhibit them should be noted, even, and

¹³⁴ For example, the legs of birds are all for the sake of locomotion, but the extremely *long* legs of some kinds of swamp dwelling birds are explained by the environment in which those birds must locomote.

perhaps especially, when the extension overlaps with many different kinds; (ii) provide a detailed and comprehensive survey of the actual differences exhibited by animals prior to any attempt at causal explanation; and (iii) should focus on the fully developed animal, as the way of being of the adult animal will form the ultimate explanatory foundation for the science of animals.

3.4 CONCLUSION

Both *APo.* and *PA I* provide important considerations relevant to the understanding of a *historia*. The above discussions of the relevant passages in *APo.* (especially book II) show that Aristotle's preferred method of investigation begins with a stage of establishing facts regarding the subject matter at hand, and proceeds by organizing those facts into "problems"—*hoti*-level propositions whose causes can now be sought. The search for these causes begins with a stage of identifying correlations between the various attributes included in the field of study. These correlations must be identified at varying levels of generality in order that the coextensive relationships may be identified. Such coextensive correlations provide the investigator with the first candidates for causal explanation, however they must remain as mere candidates until additional considerations may be brought to bear on the question of how causes operate within the specific domain of study under consideration. The collection and correlation of these facts takes place during the *historia* stage.

4.0 INTRODUCTION TO THE TREATISE: *HA* I.1-6 (486A5-491A14)

The first six chapters of *HA* (to 491a14) serve as an introduction to the rest of the treatise. Twice Aristotle describes the discussion as a *tupos* (487a12, 491a7) – a “sketch” or “outline” – designed to provide a “taste” of what will be described with precision later. This suggests that a proper understanding of exactly what is accomplished in this stretch of text should shed light on the rest of the treatise. In what sense is it a *tupos*? Is it simply an outline of the subject matter that is to be treated in the rest of the work, a framework of sorts upon which the rest of the treatise will be built? Or does it provide an example of the methodology that will be used, showing the manner according to which the investigation will proceed? Does Aristotle present any sort of philosophical reflection on this methodology, any justification for proceeding in the way that he does? Is he presenting an *argument* of some sort, which will serve as the basis for the remainder of treatise?

Balme writes of this and similar introductions in Aristotle: “Such generalities are neither formal postulates required to prove the details nor mere samples of what is to come, but something between: they are guidelines which express the real structure but are still universalized and await the more precise definition which is available only in particulars.”¹³⁵ Elsewhere he states that the purpose of the introduction to *HA* is not simply to summarize or

¹³⁵ Balme 1991, p. 18.

preview, but rather “to extract the main points for the reader’s guidance.”¹³⁶ In this chapter I will test these claims about this introductory passage by offering a careful reading and analysis of the text. I will argue that the long passage does provide a useful introduction to the entire treatise, and that it accomplishes this both by providing an outline of the contents that follow, and by offering a more theoretical reflection on important concepts and points of method that are integral to a proper understanding of the treatise as a whole, though not always taken up thematically elsewhere in the treatise.

The long passage divides into seven fairly distinct sections:

- (i) 486a5-487a10: sameness and difference of parts
- (ii) 487a11-488b28 manners of life, characters, and activities
 - a. 487a11-b32: manners of life, characters, and activities
 - b. 487b33-488b11: manners of life and activities
 - c. 488b12-28: characters
- (iii) 488b29-489a34: “most necessary” parts of animals
- (iv) 489a34-b18: modes of reproduction
- (v) 489b19-490b6: parts related to locomotion
- (vi) 490b7-491a6: discussion of *megista genê*
- (vii) 491a7-14: methodological reflection

In what follows I provide a summary of each of these major sections followed by an analysis of their contents in which I consider their relationship with the other sections of the

¹³⁶ Balme (forthcoming).

introduction and with the rest of the treatise. Following this, I consider in what sense this discussion is a *tupos* of the entire treatise.

4.1 SAMENESS AND DIFFERENCE OF THE PARTS OF ANIMALS (486A5-487A10)

This first section actually serves two distinct purposes. First Aristotle introduces a basic division of the parts of animals – that of being compounded or uncompounded – and provides a brief analysis of these terms (486a5-14, 487a1-10). Second, he introduces a typology of sameness and difference that he uses as the basis for comparing the parts of animals, as well as the other main differentiae (486a14-487a1). I have grouped these two discussions together because the typology of sameness and difference interrupts, as it were, the discussion of the parts of animals with which the treatise begins (and with which it continues after the discussion of the typology), and it thus seems more sensible to include them together in one longer stretch of text rather than break them up.

4.1.1 Summary

The treatise begins immediately with a discussion of the parts of animals, focusing on a single broad division among them: that of being compounded (*sunthetos*) or uncompounded (*asunthetos*). As Aristotle explains, compounded parts are those that may be divided or separated into non-uniform parts (*anomoioimerês*), while uncompounded parts are those that, when divided, result in uniform parts (*homoioimerês*), i.e. parts that are alike to one another and the whole. The notion of a limb (*melê*) is also introduced, presumably due to its relation to compounded parts: a

limb is a kind of part that is itself regarded as whole, but has other recognizable parts within it, such as the head (which has within it the face and its parts, the ears, the brain, etc.).

Following this is an extended discussion of the manners of sameness and difference exhibited by the parts of animals – what I’ve labeled a “typology of sameness and difference.” Three primary modes of similarity are discussed: sameness in form (*eidei*), sameness in kind (*genei*), and sameness by analogy (*kata analogian*). Examples are provided for each: one man’s nose or eyes are the same in form with another man’s nose or eyes; the beaks of two different forms of bird are different in form but the same in kind; fish scales are different in kind to bird feathers, but are the same by analogy, since “that which is feather in bird, in fish this is the scale” (486b21). Parts that are the same in kind differ by “excess and defect” (*huperochê, elleipsis*) or “the more and the less” (*to mallon kai êtton*). Such differences are typically found in contrary properties (*para tas tôn pathêmatôn enantiôseis*), such as color and shape. Examples include harder or softer flesh, longer or shorter beaks, and more or fewer feathers. Other forms of difference include the possession or absence of a part (e.g. some birds possess spurs or crests while others do not), and the placement of a part (e.g. the teat of female animals is sometimes on the breast, sometimes near the thigh).

The section concludes with a few additional remarks regarding uniform parts. Two pairs of contrasting differentiae are introduced: soft and fluid (*malaka kai hugra*) and hard and firm (*xêra kai stereia*),¹³⁷ and examples of each are given: e.g. soft and fluid are blood, marrow, semen, and milk; hard and firm are sinew, skin, blood-vessel, hair, and bone.

¹³⁷ These same pairs of differentiae are introduced at *PA* II.2, 647b10-19.

4.1.2 Analysis

4.1.2.1 The peculiarity of *HA*'s introduction

It is noteworthy that the treatise begins by immediately entering into a discussion of the sameness and difference of parts. It is not until 487a10 (about a Bekker page) that Aristotle provides a fuller picture of his project (i.e. a discussion of the differences exhibited by animals), and not until 491a7 (about five Bekker pages) that this project is more clearly explained. Aristotle's purposes come to be clearer as the reader progresses, but this hasty beginning—lacking any methodological introduction—has suggested to some scholars that *HA* is not a “polished” treatise, and perhaps was not meant for a wide reading audience.¹³⁸ However, this lack of literary polish need not suggest that the treatise is poorly arranged or structured; on the contrary, it is a goal of this chapter to argue for much the opposite. Although this introductory section begins with little fanfare, it does serve as an *introduction*, and thus reflects a plan and organization of thought, as we shall see more clearly as we proceed.

Nonetheless it must be emphasized that *HA* differs considerably in its opening passages from most of Aristotle's other treatises. It is typical for Aristotle, in the opening lines of a treatise, to identify the primary subject matter under discussion, and to locate that subject matter within a broader field of study. Often he will also discuss the methodology that should be used in the investigation and why it is fitting for the subject matter at hand. To take the main biological treatises as examples, *PA*¹³⁹, *GA*¹⁴⁰, *IA*, *MA*, and *Sens.* (the first treatise of the *Parva Naturalia*)

¹³⁸ See Louis 1964, xi-xiv.

¹³⁹ *PA* I, a reflection on method and explanation in biology, is appended to *PA* II-IV as it is relevant to the explanatory project undertaken there. This has led some scholars to conjecture that *PA* I began its life as an independent treatise. Even if one were to consider

all include such introductory passages that serve to situate the reader. While *HA* does include such a reflection on subject matter and methodology, it appears much later in the work, and not “front and center,” as it were, in the beginning. Why does *HA* lack such an introduction?

It may reflect the *purpose* of the treatise: for whom is the treatise written? What is the reader expected to learn from it? If the primary goals of the treatise are centered around gathering facts about the differences exhibited by animals in order that they may be explained later, then methodological discussions of explanation and investigation perhaps need not be included, since such explanations form no part of the goals of the present work. However, as the methodological reflection in *HA* I.6 indicates, as well as our earlier discussions of *APo.* II, considerations of cause and explanation *do* come into play, even at the early stage of investigation of collecting and organizing facts. Why then do we not find a more lengthy discussion of these issues, and why not here at the beginning of the treatise?

A complete answer to this question will have to wait for a more detailed study, not just of these introductory passages, but of the whole *HA*. At this point we may conjecture that the lack of a typical Aristotelian introduction may reflect the differing *purpose* of the *HA* as compared to most other treatises in the corpus. As we saw in the introduction to this dissertation, Louis has suggested that *HA* was not meant to be a widely circulated or read treatise, but rather served as a repository of sorts, a record of facts that were to be used in later, explanatory treatises. If this were the case, then an introduction of the style typical to other Aristotelian works would not be necessary, since the reader of the treatise would presumably be the very researcher endeavoring

PA I as a separate treatise, the bulk of the *PA* itself begins, in *PA* II.1, with a general statement on what is to be accomplished in the treatise.

¹⁴⁰ Balme brackets the opening salvo of *GA* I.1, calling it a “stylized preamble” that may be “post-Aristotelian” (Balme 1972, p. 127). If he’s right, then, like *HA*, *GA* too begins rather abruptly, launching immediately into a discussion of the male and the female.

to explain the phenomena collected therein. The *HA* would be little more than a notebook of facts and observations of animals, needing no further introduction for the intended reader.

However, this picture of the *HA* does not square with the rather more complicated organization we find in the work. As Lennox and Gotthelf have argued, the *HA* is not merely a notebook of observations, but stands somewhere in between the researcher's field notebook and the sort of explanatory work we find elsewhere in the corpus.¹⁴¹ Its focus is not just on data, but also on "data organization" – it occupies a place "between data and demonstration." This suggests that the treatise has a purpose beyond the mere recording of data, and that this purpose could profitably be explained (and defended) in an introduction of a sort similar to other treatises in the corpus. As mentioned above, the *HA* *does* contain such an introduction, only it is not structured in the typical way. As we shall see, it begins by immediately offering examples of the sort of data is to be collected, and only later discusses and defends the methodology to be used. This suggests that the intended reader is, on the one hand, not entirely unfamiliar with the investigation and subject matter at hand, since Aristotle apparently felt no need to immediately situate this reader in the discussion. But, on the other hand, it also suggests that an introduction of some sort was in fact necessary to guide the reader's further progress through the treatise. It may be that even the reader familiar with Aristotle's investigation into nature and/or animals would benefit from an introduction that looks forward to the rest of the treatise, sets expectations regarding the material that is to be covered, and provides examples and discussions of the methodology that will be employed throughout the work. Such an introduction would not need to locate the present investigation within the broader perspective of Aristotle's natural philosophy.

¹⁴¹ Lennox 1991, Gotthelf 1988, 2012b.

This suggests that the purpose of the treatise is primarily a pedagogical one, aimed not at the general reader, or even the more sophisticated reader familiar with the main themes of natural philosophy. Rather it is aimed more at the specialist; it is intended to educate the budding investigator of the animal world in such a manner as to prepare him to carry out the sort of explanatory work we find in treatises like *PA* and *GA*.¹⁴² If this is the intended reader, then no extended introduction situating the study of animals within the broader study of nature is necessary, for the reader would already be familiar with the relationship between these studies. However an introduction of a different sort would be necessary in order to aid the student in using the treatise to master the vast amount of information contained in the work.

4.1.2.2 Differences in the parts of animals

Returning to the text, Aristotle does not employ the distinction he introduces first, that of being *sunthetos/asunthetos*, in the rest of the treatise, but instead favors *anomoioimerês* (or occasionally *organikos*) over *sunthetos*, and *homoioimerês* over *asunthetos*.¹⁴³ The distinctions Aristotle draws here, however, do not allow us simply to equate *asunthetos* with *homoioimerês* and *sunthetos* with *anomoioimerês*. As the etymologies suggest, the distinction *sunthetos/asunthetos* refers to whether a part is *made up of* or *put together out of* other recognizable parts, while *homoioimerês/anomoioimerês* refers to whether the part is made up of *like parts*, i.e. parts similar to the whole, though not necessarily distinguishable from the whole. The distinction *homoioimerês/anomoioimerês*, together with that of parts being internal or external

¹⁴² Lennox points out that a third option is available, namely that the treatise is aimed not at the specialist *per se*, nor at a general reader, but rather at anyone interested in learning about how to properly gather and organize data for scientific explication, regardless of the field. This reader would fall somewhere inbetween the general reader and the specialist.

¹⁴³ For *anomoioimerês/organikos* over *sunthetos* see e.g. *HA* I.6, 491a26, III.1, 511a35, IV.1 523a32; for *homoioimerês* over *asunthetos* see *HA* III.2, 511b2, IV.1 523a32.

(*entos/ektos*), forms the basic division of the parts of animals that Aristotle uses to structure his discussion in books I-IV.¹⁴⁴

PA II.1 begins with a similar discussion of the *sunthesis* of animal parts. But there, in addition to *homoioimerês* and *anomoioimerês* Aristotle includes a third, lower level of composition: the “so-called elements” (*tôn kaloumenôn . . . stoicheiôn*), earth, air, fire, water, which he identifies with the four primary capacities or powers (*dunameis*), hot, cold, wet, dry, that define/underlie the elements (646a12ff). This suggests a three-fold composition of animal parts (*dunameis/stoicheioi*, *homoioimerês*, *anomoioimerês*). This same lower-level division of the elements into their primary *dunameis* is also discussed in *GC*¹⁴⁵. Balme has stressed that these passages need to be considered in context, and that any discrepancies between them can be accounted for based on “the limits of the argument” presently under consideration.¹⁴⁶ This might suggest that the discussion in *HA*, with its focus on the dual-level composition *homoioimerês/anomoioimerês*, is concerned primarily with the *observable* composition of animal parts.¹⁴⁷ Any understanding of the further composition of *homoioimerê* parts requires a rather sophisticated theoretical analysis that takes us many steps beyond what is simply observable.¹⁴⁸
¹⁴⁹ This accords well with the avowed pre-causal, pre-explanatory nature of *HA*. The more complex analysis of composition that appears in *PA* fits well with the explanatory project of that

¹⁴⁴ See chapter 5, section 2.2 for an outline of the discussion of parts of animals in *HA*.

¹⁴⁵ *GC* II, 329a35

¹⁴⁶ Balme (forthcoming).

¹⁴⁷ Balme (forthcoming) cites Galen as expressing a similar view.

¹⁴⁸ While we can observe certain of the *dunameis* present in the *homoioimerê* parts (e.g. some are *hugros* while others are *xêros*, 487a2), Aristotle holds that the perceptible presence of a *dunamis* is not necessarily indicative of the role of that *dunamis* in the part’s composition. See *PA* II.2.

¹⁴⁹ *Meteo.* IV offers just such an analysis.

treatise, as many of the features of a given part will be explained by the part's material composition and the corresponding capacities of that composition.

As with the compounded/uncompounded distinction, Aristotle does not use the notion of *melos*, or limb, elsewhere in the *HA*. If a *limb* is a part that possesses a sort of unity and wholeness of its own while also being comprised of other parts, then is a *limb* simply a *compounded part*? Perhaps so, as *hand* is explicitly mentioned in both categories.¹⁵⁰ But the popular extension of the term *melos* may not have referred to some parts that Aristotle considers *sunthetos*, such as the face, so Aristotle may have thought it best to keep the concepts separate.

That these distinctions are here introduced but not subsequently used may suggest that Aristotle composed this introduction prior to writing the rest of the treatise, and never returned to update the terms used.¹⁵¹ Alternatively, their use here may simply serve the purposes of the introduction without there being any need of repeating them later.¹⁵² For instance, clarifying the relationship between *moria* and *melos* at the beginning of the treatise may clear the way for leaving aside the concept of *melos* as the treatise proceeds. Similarly, familiarizing the reader with the concepts of compounded and uncompounded parts may clarify that by “part” Aristotle means both the complex parts of animals that have a distinctive form of their own, and the “materials” of which such parts are composed.

Aristotle twice states that it is primarily by their parts that animal kinds are differentiated,¹⁵³ and it is presumably by their parts that we are first acquainted with them and

¹⁵⁰ At 486a7 and a11.

¹⁵¹ As discussed further below, other such *differentiae* are introduced in the long introductory passage and not subsequently used.

¹⁵² To what extent are these “technical” terms, already in use in the anatomic writings that are contemporary to Aristotle?

¹⁵³ *HA* I.6, 491a16; *PA* I.4, 644b8.

the differences between them, as these are most obvious to perception. So beginning *HA* with a discussion of parts is appropriate. The organization of *HA* reflects this as well: the first four books are dedicated to parts. And while the discussion of the forms of sameness and difference is keyed to the parts of animals, the same typology also applies to the other categories of differentia, as is made explicit later in the treatise,¹⁵⁴ and implied in the proceeding discussion.

In this opening section Aristotle introduces certain differentiae relating to parts (i.e. compounded, uncompounded, etc.), and provides examples of parts that exhibit these differentiae, but he does not go into any detail regarding exactly what parts are found in animals, which are most common, which are most distinctive, etc. Instead this introductory section is aimed at providing the reader with the basic concepts needed to begin such a survey of the parts of animals. And indeed this is what we find later, though not immediately following this section.

4.1.2.3 Typology of sameness and difference

The modes of similarity and difference Aristotle introduces – in form, in kind, and by analogy – provide the basic framework that is used to compare the parts of animals. The passage has been of particular interest to scholars due to the conspicuous use of the terms *eidos* and *genos*. It is now generally recognized that for Aristotle, at least within the biological works, these terms do not indicate fixed levels of taxonomic classification.¹⁵⁵ Rather a *genos* may comprise any grouping of *eidê* that exhibit some similarity that is relevant to the investigation at hand. The relationship is typically “one of inclusion”¹⁵⁶, with many *eidê* organized beneath a single *genos*. However *genos* is sometimes used to refer to a kind without any recognized lower forms, and

¹⁵⁴ *HA* VII.1 588a20ff.

¹⁵⁵ See Pelligrin 1986, Balme 1987b, p. 72.

¹⁵⁶ Balme (forthcoming).

eidos is sometimes used to refer to a higher level form that embraces lower level forms, like a kind.¹⁵⁷ The terms are used both for whole animals as well as their parts (i.e. forms/kinds of animals, forms/kinds of parts). Aristotle's rather loose usage of the terms can cause confusion if one hews too closely to strict demarcations, but their use in any given passage can typically be defended.

This relativity in the use of the terms *eidos* and *genos* raises the question of whether the modes of similarity and difference *same/different in eidos/genos* also exhibit the same relativity. In this passage, Aristotle states that the relation of sameness that holds between two animals considered as wholes holds as well with their parts ("as the wholes are to the wholes, so also are each of the parts to each" (486a20)), such that if two whole animals are the same in *eidos*, then so are their parts. But if two whole animals are considered to be the same in *eidos* in some contexts, but not in others, then the relation *same in form* would also hold in some contexts, but not others. The examples he gives (nose, eye, flesh, bone of one human compared to another human; same parts of one horse compared to another horse) render it ambiguous whether the animals in question here (humans, horses) are lowest-level forms, having no further differentiation (this is certainly true of *human*, but less clear with *horse*).¹⁵⁸ If this were the case it would fix the reference of *same in form* to those lowest level forms, and provide a more firm sense to the relation. However it is uncertain whether the present passage gives it this sense. He

¹⁵⁷ See e.g. *HA* I.6, 490b17, and my discussion of the passage in Appendix C.

¹⁵⁸ Lennox points out that it is not entirely clear that Aristotle recognizes a "lowest-level" kind/form above that of the individual. At *PA* I.4, 644a23ff. Aristotle writes: "Since, however, it is the last forms (*eskata eidê*) that are substantial beings, and these, e.g. Socrates and Coriscus, are undifferentiated with respect to form (*ta to eidos adiaphora*) . . ." This suggests that the true *eskata eidê* belong to concrete individuals, but since these are "undifferentiated with respect to form", a higher-level *eidos* may be abstracted from the individuals. It seems that it is this first higher-level *eidos* that Aristotle has in mind in his discussions of "same in form" in *HA*. See Lennox 1987b.

does state that the relation holds for “as many animals as are said to be the same in form” (486a19), but this does nothing to settle the question.

A similar statement regarding the sameness and difference of the parts of animals appears at the beginning of *HA* II.1:

[1] Regarding the parts of animals, some are common to all, just as was said earlier, while others [are common] to certain kinds [of animals]. And these are the same or different from one another in the manner already repeatedly stated. For practically all animals that are different in kind also have the majority of their parts different by form, and some [parts] do not differ (i.e. are the same) by analogy alone, being different by kind, and still others are the same by kind but differ by form. And many belong to some, but not to others.

497b6 Τῶν δ' ἄλλων ζῴων τὰ μέρη τὰ μὲν κοινὰ πάντων
ἐστίν, ὥσπερ εἴρηται πρότερον, τὰ δὲ γενῶν τινων. Ταῦτα δὲ
καὶ ἕτερα ἐστὶν ἀλλήλων τὸν ἤδη πολλάκις εἰρημένον τρό-
πον. Σχεδὸν γὰρ ὅσα γ' ἐστὶ γένει ἕτερα τῶν ζῴων, καὶ τὰ
b10 πλεῖστα τῶν μερῶν ἔχει ἕτερα τῷ εἶδει, καὶ τὰ μὲν κατ'
ἀναλογίαν ἀδιάφορα μόνον, τῷ γένει δ' ἕτερα, τὰ δὲ τῷ
γένει μὲν ταῦτα τῷ εἶδει δ' ἕτερα· πολλὰ δὲ τοῖς μὲν
ὑπάρχει, τοῖς δ' οὐχ ὑπάρχει.

Here, beginning with the *gar* clause in 497b9, Aristotle lays out the following relationships between animals and their parts:

<u>Animals</u>	<u>Parts</u>
Different in kind	Different in form
Different in kind	Same by analogy, different in kind
Different in kind	Same by kind, different by form
Different in kind	Present in some but not others ¹⁵⁹

The sense of the passage is as follows. Some parts are common to (that is, present or possessed by) all animals, while other parts are present only in certain kinds of animals. And these common parts, as they appear in different kinds of animals, are similar and different in the ways sketched out earlier. For, most animals that differ in kind have parts that differ in form. It may be that these parts that differ in form are the same in kind (that is, differ only by the more or the less), or it may be that these parts that differ in form are the same only by analogy (and thus differ also by kind). It may also be that some parts are not common, but present only in some kinds of animals, and absent in the others.

Again, the usage of these terms does not seem to designate rigid divisions or classifications, but the general sense, gleaned from the passages in I.1 and II.1 above, is clear: animals that are the same in form have parts that are the same in form; animals that are the same in kind but different in form will have parts that are largely similar, differing only by the more or

¹⁵⁹ This is sometimes the case for animals that belong to the same kind, e.g. some birds have a crest, spurs, etc., while other birds do not.

less; animals that are of different kinds may have some parts that are broadly similar, differing by the more or less, but will likely have other parts that are only analogously the same. Finally, animals that differ in kind may have parts that are present in some kinds but not others.

An important question that Aristotle leaves largely unanswered in these passages is exactly what the basis is for sameness by analogy. It is tempting to read in something like sameness of function, but Aristotle's stock examples do not always support this. In *HA* I.1 he offers the following examples of sameness by analogy: bone to fish-spine, nail to hoof, hand to claw, and bird feather to fish scale. What these examples seem to have in common more than function is location or placement on the animal's body: nail and hoof are both hard uniform parts located at the end of the extremities; similarly with hands and claws, though the first are uniform and the second non-uniform parts; feathers and fish scales form the outer covering of the respective animals, but seem to serve rather different purposes. There are perhaps some functions that these parts share, but it seems that function is not the sole basis of sameness by analogy in all cases.¹⁶⁰

To what extent does Aristotle make use of these notions of sameness and difference in the rest of the treatise? Implicitly, the notions are put to use quite frequently, especially those of sameness by form and sameness by kind. Often, when discussing differences in a feature belonging to animals of the same kind, he will describe the differences in terms equivalent to "more or less" or "excess and defect" without specifically calling out these as being differences in *eidos* and similarities in *genos*. It is more common for sameness by analogy to be explicitly

¹⁶⁰ See Wilson 2000, ch. 2, especially pp. 69-72; Lennox 2001a, pp. 168-9, 175.

called out, but again, the looseness¹⁶¹ with which these terms are sometimes used renders it difficult to draw hard and fast lines of demarcation between them.

4.1.2.4 Differences in uniform parts

The final comments in this section on uniform parts are meant, first, to present the reader with basic differences found among these parts and to provide examples of uniform parts that embody these differences. But, second, these final comments also extend the typology of sameness and difference explicitly to the uniform parts. The examples of uniform parts that are either soft and fluid or hard and dry include explicit reference to parts analogous to these. In other words, the uniform parts specified have analogues present in some animals, and thus the notion of analogical similarity applies even to the uniform parts.¹⁶² Thus Aristotle can use uniform parts to exemplify the different modes of similarity and difference: e.g. the blood of two horses is the same in form; the blood of two different forms of bird is the same in kind but different in form; the blood of a blooded animal is the same by analogy to the fluid substance in bloodless animals.

4.1.2.5 Concluding thoughts on 486a5-487a10

In this long introductory passage Aristotle both introduces the first, and perhaps primary, form of differentia to be studied in the treatise – the parts of animals – and he begins to develop the framework within which differentia may be collected and compared – the typology of sameness and difference. Beginning as he does with parts is sensible if he is correct in claiming

¹⁶¹ Lennox suggests “abstractness” rather than “looseness.”

¹⁶² As is noted in the comparison of bone vs. fish-spine and nail vs. hoof at 486b19.

that it is primarily by their parts that we first come to be familiar with animals.¹⁶³ The transition to the other forms of animal differentia, discussed in the next section, is thereby rendered less abrupt, since the reader is led from a form of differentia that is more familiar to one that is, presumably, less so. The development of the typology of sameness and difference with reference to parts also serves the same purpose – it provides the reader with concrete examples that are perhaps more easily grasped, compared to e.g. manners of life or activities. The rather abrupt beginning to the treatise perhaps reflects the intended audience or reader, one who perhaps did not require a more thorough introduction to the subject matter at hand, and the use they seek to make of the information provided.

4.2 BIOS, PRAXIS, ÊTHOS (487A11-488B28)

In this long passage Aristotle discusses differences of animals that are in some sense related to the three major forms of differentia other than parts: manners of life, activities, and characters. The section begins by announcing that the discussion will be given in outline first, while attention will be paid to “each kind” later:

[4] The differences of animals are with respect to manners of life, activities, characters, and parts, regarding which we shall speak first in outline, and later we shall speak focusing on each kind. (487a11-12)

¹⁶³ A claim I explore in more detail below. See ch. 5, sec. 5.1.11.

487a11 Αἱ δὲ διαφοραὶ τῶν ζώων εἰσὶ κατὰ τε τοὺς βίους καὶ
 τὰς πράξεις καὶ τὰ ἥθη καὶ τὰ μόρια, περὶ ὧν τύπῳ μὲν
 εἵπωμεν πρῶτον, ὕστερον δὲ περὶ ἕκαστον γένος ἐπιστήσαντες
 ἐροῦμεν.

To what does “each kind” (a13) refer? The options seem to be either each kind of *animal* (picking up on *zôôn* in a11) or each kind of *diaphora* (also in a11). The latter seems more likely, as *diaphorai* is the grammatical subject of the sentence, and the remark is immediately preceded by an enumeration of the different kinds of *diaphora*. Further, although the major kinds of animals are used as organizing principles throughout the treatise, the different kinds of *diaphora* act as higher organizing principles, with each discussion of a kind of *diaphora* subdivided in various ways, sometimes by the major kinds (*megista genê*) of animals, but sometimes by other divisions. Thus the discussions in the rest of the treatise are focused on each kind of *differentia* more so than on each kind of *animal*.¹⁶⁴ This statement is paralleled by a later one at the end of the introductory section (491a7), repeating that the discussion is offered as a *tupos*.

Aristotle does not proceed by addressing each of the three remaining kinds of *differentia* separately, e.g. treating manners of life first, activities second, and characters third. Instead, he begins by considering differences under the heading of manners of life, characters, and activities (487a11-b32), then proceeds to differences related to manners of life and activities (487b33-488b11), and concludes with differences related to characters alone (488b12-28). The entire section concludes with a statement that explicitly mentions characters and manners of life, but

¹⁶⁴ In his edition of *HA*, Peck did not fully appreciate this fact, and instead often uses animal kinds in his marginal notes. Further, the Renaissance-era chapter divisions often reflect this misunderstanding.

leaves out activities (488b27).¹⁶⁵ Thus it is not clear whether the actual differences discussed in each subsection (e.g. water animal, land animal, etc.) are examples/instances of one of the categories of differentia, or whether such features fall under more than one category, or whether the features somehow *affect* the specified forms of differentiae, without themselves falling neatly under a single category (e.g. being a water animal is not itself a manner of life, an activity, or a character, but *affects* the manner of life, activities, and character of the animal). That *activities* is left out of the concluding statement at 488b27, while it is specifically mentioned in the introductory statements of the first two subsections, may suggest that we should not read too deeply into the terms' appearance or absence in these statements. But it seems unlikely that Aristotle should introduce these three forms of differentia here, only to immediately blur their distinctions.¹⁶⁶ We shall return to this question below.

In what follows I provide a brief summary of each of the three major subsections of the long passage, followed by an analysis and interpretation of their contents and their relationship to one another.

¹⁶⁵ In each of the statements, the differentiae are connected with a *kai*. If this is a typical conjunctive use of *kai*, then the features discussed in the first subsection would pertain to manners of life *and* activities *and* characters, with each feature pertaining to all three forms of differentia. But *kai* can also be used to indicate a disjunction (Smyth 2877), so that the features introduced in each subsection pertain to one or the other of the differentiae mentioned, though not both.

¹⁶⁶ My thanks to Allan Gotthelf for helping me think through this passage (as with so many others).

4.2.1 Manners of life, characters, and activities (487a11-488b28)

4.2.1.1 Summary

Aristotle introduces the first subsection by stating: “Such differences are according to manners of life, characters, and activities” (*eisi de diaphora kata men tous bious kai ta êthê kai tas praxeis hai taoiaide*) (487a14-15). Two main divisions, with four corresponding differentiae, are considered: water animal vs. land animal (*enudra/chersaia*, 487a15-487b6) and stationary vs. capable of movement (*monima/metablêtika*, 487b6-487b33). First, several senses in which an animal may be considered a water animal are distinguished,¹⁶⁷ and examples of specific animals that fall under each sense are provided. The emphasis is on where these animals live, what they eat, what they take in and expel, and where they procreate. Similar distinctions are made for land animals, and further examples are given. The discussion then turns to the difference of being stationary versus capable of movement, with particular attention paid to the unusual cases of water-dwelling animals that are immobile and live attached to things. This leads to a discussion of the different ways in which an animal can be *metablêtika* or capable of moving about – swimming, walking, flying, etc. The section closes with an aside about animals with “bad feet” (*kakopodes*) and the so-called “footless” (*apodes*) bird.

4.2.1.2 Analysis

enudros/chersaia

That Aristotle begins the discussion with the difference water animal/land animal suggests that he places great importance on these differentiae. This is reflected later in the

¹⁶⁷ See Peck, 1965, pp. lxxvi-lxxxvi for an exhaustive survey.

treatise, as the difference is often used as an organizing principle of discussion (e.g. begin by discussing differentia X as it is exhibited by water animals, then land animals), and many features and characteristics of animals vary with this difference (e.g. parts associated with locomotion, cooling of natural heat, modes of reproduction, etc.).¹⁶⁸

The discussion of water animals brings to light an important point that is perhaps not immediately obvious to the casual observer of the animal world: not all water animals take in and expel water in the manner that most land animals take in and expel air (though not even all of these do this). Rather, there are a great many animals that by Aristotle's lights are rightly identified as water animals, though they do not take in water. At 487a16ff Aristotle distinguishes three different senses in which an animal may be water-dwelling:

water-dwelling I (e.g. fish)

- live in water (*ton bion/tên diatribên poieitai en tô higrô*)
- feed in water (*tên trophên poieitai en tô higrô*)
- take in/expel water (*dechetai kai aphîêsi to higrôn*)
- unable to live deprived of water (*[tou higrôu] steriskomena ou dunatai zên*)
- (breed in water)¹⁶⁹

water-dwelling II (e.g. beaver, crocodile, plunger, water-snake)

- live in water
- feed in water

¹⁶⁸ Examples include gills vs. lungs, fins vs. legs, swimming vs. walking, etc.

¹⁶⁹ I have included in parentheses features that are probably assumed present though unstated by Aristotle.

- take in/expel air
- (able to live deprived of water)
- breed on land

water-dwelling III (sea-anemone, certain shellfish)

- (live in water)
- feed in water
- take in/expel neither air nor water
- unable to live deprived of water
- (breed in water)¹⁷⁰

What is it that these animals share, that qualifies them all as water animals? Based on the lists above, *living* and *feeding in the water* are the features shared by all such creatures. They differ in regards to what they take in and expel (water, air, nothing), where they breed (in water, on land), and whether they are capable of living without water.¹⁷¹ The point of the analysis is to immediately remove the misconception that all water animals take in and expel water. What it is

¹⁷⁰ All of these animals are, according to Aristotle, spontaneously generated in water.

¹⁷¹ Presumably by *being able* or *unable to live deprived of water*, Aristotle is referring to whether the animal can live *even for a relatively brief period of time* away from the water. For example, the beaver and the crocodile, and even the dolphin, can live for sometime outside of the water, though ultimately their survival necessitates their return to the water, some sooner, others later. For Aristotle this feature cannot be reduced to *taking in and expelling water*, even though such animals cannot live deprived of it. This is because according to Aristotle some animals do not take in or expel *anything* and yet still cannot live for long deprived of water. Thus for them it is not the taking in and expelling of water that is key. Ultimately, however, the reason why both sorts of animals cannot live deprived of water is the same: they need water to cool their natural heat. Some animals accomplish this by taking in and expelling water, while others affect the cooling of their natural heat simply by being in contact with the water in their environments.

to be a water animal, in the most strict or governing sense, must not rely on this feature. Nonetheless here, as in the more detailed analysis in VII.2, Aristotle is keen to preserve the sense of *enudros* that includes taking in and expelling water. The reason, we learn in VII.2, is that taking in water for cooling seems to be the more natural condition of water animals. Aristotle describes those water animals that take in air as having a nature that has been “distorted” (589b29). In these cases some small change in a “source-like” part (*archoeides*, 590a4) causes the animal’s development to change from one side of the division to the other. In the case of these water animals that respire air, it is as if the creature begins as a land animal, but early in its development takes in matter from a watery environment. Since its feeding must ultimately correspond to the matter out of which it is formed (589a6), the animal develops into a “water” animal, in the sense that it must feed in the water, and thus live and spend most of its time in the water. However, its early beginnings as a land animal cause it to continue to respire air, as most land animals do. Thus these animals “tend to both sides” and are not easily categorized as solely land or water animals. What these water animals share with those that take in and expel water for cooling is that their bodily constitution or “blend” (*krasis*) is watery in nature, and requires that they feed and spend most of their time in the water. Aristotle will use the term *enudros* to refer to both types of water animals, admitting that a distinction needs to be recognized, but he refuses to restrict the term’s use.

Aristotle notes that water animals that take in and expel air may be footed, winged, or footless (487a21ff.). Why? It may be simply to show the great variety in modes of locomotion exhibited by such animals, but it may also be to state firmly that there is no correlation between being a water animal in this sense and mode of locomotion. The casual observer may hold that being a water animal in the first sense (i.e. taking in and expelling water) is correlated with

swimming as a mode of locomotion. After all, this holds of all fishes, which are perhaps the prime example of such water animals. Aristotle may be intending to dispel the assumption that a single mode of locomotion always correlates with being a water animal. Whatever Aristotle's point in doing so, it is of note that he makes explicit this lack of correlation, as identifying such instances of correlation (or lack thereof) is sometimes put forward as an important aim of *HA*. Here we find perhaps the first important instance of it; we will return to discuss the importance of this aim as we proceed.

The brief analysis of land animal (*chersaia*) is geared towards making a similar point: not all land animals take in and expel air: some take in air and others take in nothing (though no land animal takes in water). Aristotle specifies that all land animals with lungs take in air, and though he does not elaborate the point here, this comment is fitting with an insight Aristotle is often at pains to emphasize. That is, in order to perform a given function, an animal needs the appropriate part or parts. Since the lung is the part by which animals take in and expel air, only animals that possess the lung do so. Thus any animal that does not possess the lung does not take in air, and the presence of a lung implies that the animal does take in air.

While this point may seem obvious, Aristotle repeatedly invokes the principle when criticizing his predecessors' accounts of animal parts and activities. For example, at *GA* III.5, 756b4ff. he criticizes the view that female fish become impregnated by swallowing the milt from the male on the grounds that the anatomy of the fish is such that anything passing through the mouth arrives immediately in the stomach. How, Aristotle wonders, can the milt make its way to the female fish's womb from the stomach? Similarly in *Resp.* 3 Aristotle dismisses the view that fish somehow take in air from the water through the mouth, and his argument is again based in part on the anatomy of the fish. In fact, Aristotle there asserts that his predecessors' failure to

give a correct account of respiration (or its analogue in fish) is due to their inexperienced with or ignorance of (*apeirous*, 471b25) the fish's internal parts, and their failure to ask what respiration is for when examining the parts.¹⁷²

monima/metablêtika

The analysis of water animal and land animal is immediately followed by a discussion of the differences stationary (*monima*) and capable of movement (*metablêtika*). Aristotle immediately draws a connection between these differentiae: all stationary animals are water animals – none are land animals. But is there another reason why he turns to this set of differentiae next? It might be that the capacity for movement is a characteristic typically associated with animals, so that there may be some confusion regarding whether a living thing could be an *animal* and *stationary*.¹⁷³ Aristotle himself expresses many reservations regarding whether such stationary living things are indeed animals (as opposed to plants), but that at least some of them are correctly so considered is, to Aristotle, clear, and thus treating this differentia first, or at least among the first, settles the question and clear the way for further investigation.¹⁷⁴

Further, it is easy to see how many other features of an animal will depend upon its ability (or inability) to move about. This holds especially for the two classes of activity Aristotle later states to be the most prominent in animals: feeding and reproduction.¹⁷⁵ A living thing that is unable to move about will be seriously constrained in the ways in which it can perform these activities.

¹⁷² On this see Lennox

¹⁷³ See *HA* VII.1, 588b12ff.; *An.* I.2, 403b26, 405b11; II.2, 413a24; III.3, 427a17.

¹⁷⁴ On this topic see Lloyd's "Fuzzy Natures" in his 1996, ch. 3.

¹⁷⁵ See *HA* VII.1, 589a2ff.

We may now ask, in which category of differentia do these characteristics fall? Are they *bioi*, *praxeis*, or *êthê*? Or do they fall under more than one category? Or do they not fall neatly under any single category, but somehow affect all three? Prior to a more detailed examination of the books of *HA* that are devoted to these differentiae, it may be too soon to answer this question with great confidence. However, we may venture this much. It seems that the difference water animal vs. land animal is not itself a difference of *activity*, but rather one that plays a role in determining how certain activities are performed. If an animal lives and spends most of its time in the water, then its feeding, breeding, and cooling of natural heat will have to be adapted to that environment, even if living in the water does not alone determine how these activities are performed. Later, in VII.2, we are given a more detailed account of the relationship between an animal's environment, material composition, and feeding habits, and thus a fuller picture of how being a water animal or land animal is related to the many activities an animal performs. Absent any fuller account of what Aristotle means by *manner of life* (and we find no such fuller account here in *HA* I.1-6), we may propose that by *bios* Aristotle does not intend any definite activity or set of activities. Rather an animal's *bios* specifies some feature of the animal that plays a role in determining how its activities are performed.¹⁷⁶ In the case of being a water animal, this feature is "living and spending one's time in the water." We might say the same thing about the difference of being stationary vs capable of motion: this difference will have an enormous impact on how an animal performs whatever activities are natural to it, but the characteristic does not itself seem to constitute an activity.

¹⁷⁶ See Lennox 2010b, where he argues that *bios* is an "inherently relational" feature that ties "a variety of particular modes of activity of an animal to its overall way of interacting with its environment, organic and inorganic" (p. 243).

It should be noted that nowhere in this subsection does Aristotle explicitly relate the differentiae water/land animal or stationary/capable of movement to the characters exhibited by such animals, though character is included in the introductory sentence. Do we have any reason for thinking that e.g. being a water animal plays a decisive role in determining the characters exhibited by the animal? At this point, we must answer no: nothing in the preceding remarks suggests how being a water animal or being capable of movement might affect an animal's character traits. One might speculate that the differentia *monima*, belonging as it does to relatively "incomplete" animals that show little in the way of cognitive capacity, is correlated with the near total absence of *ethos*, but little in the preceding passage leads the reader to make such a correlation, so that the appearance of the term *ethos* in the opening line of this section remains mysterious. As we shall see immediately below, the next subsection specifically leaves character out of the introductory statement, but many of the features discussed there do seem intimately connected to *êthos*. The import of this will be discussed below.

4.2.2 Manner of life and activities (487b33-488b11)

4.2.2.1 Summary

The next set of differences discussed are "according to manners of life and activities." Unlike the previous section these differences are not explicitly associated with character.

First, Aristotle considers the different manners in which animals can live with and relate to one another – their social and political organization. Animals may live together, like herd-animals (*agelaia*), or they may be solitary and live largely alone (*monadika*). Or, as a third option, they may "tend to both sides" (*epamphoterizei*), i.e. be herd-animals in certain aspects of their lives, but solitary in others. Further, animals may be political (*politika*), sharing some

common activity, or they may live scattered about (*sporadika*), largely unrelated to one another. Some political animals live under a leader (*hêgemonia*), while others are ruler-less (*anarcha*). Among both animals that live with one another and those that live alone, some live in a single location/remain in one place (*epidêmêtike*), others change their location/are migratory (*ektopistika*).

Next is a consideration of the feeding habits of animals, focused specifically on what kinds of food different animals eat. Some are “flesh-eaters” (*sarkophaga*), others are “fruit-eaters” (*karpophaga*), and others are “all-eaters” (*pamphaga* – “omnivorous”). Some animals have a diet that is unique or peculiar (*idiotropha*); for example bees primarily feed on honey, spiders on flies, and some animals on fish. The discussion then briefly turns from what different kinds of animals eat, to how they procure their food, and whether they store it or not. Some animals primarily hunt for their food (*thêreutika*); some keep food in store or reserve (*thêsauristika*), while others do not.

Some animals live in a fixed dwelling or “house” (*oikêtika*), while others do not (*aoika*). Animals also differ according to the place (*topos*) where they typically live: some live in underground holes (*trôglodutika*), others live above ground (*hupergeia*). Some burrow holes themselves (*trêmatôdê*), others do not (*atrêta*).

The remaining differences discussed in this passage include: nocturnal vs. living in daylight (*nukterobia/en tôi phôtî zêi*); tame vs. wild (*hêméra/agria*); capable of producing sound vs. mute (*psophêtika/aphôna*), and amongst these, having a voice (*phônêenta*) that is capable of articulate speech (*dialekton echei*) or inarticulate (*agrammata*); babbling or silent (*kôtila/sigêla*); musical/tuneful or not (*ôidika/anôida*); living in the country or mountains or near humans (*agroika/oreia/sunanthrôrizai*); libidinous vs. chaste (*aphrodisiastika/agneutika*); of animals that

live in the sea, living far out to sea vs. near the shore vs. on the rocks (*pelagia/aigialôdê/petraia*); quick to attack as a means of defense vs. cautiously defensive (*amuntika/phulaktika*).

4.2.2.2 Analysis

More so than the previous section, which focused on two sets of differentiae, this section is characterized by the introduction of a multitude of differentiae, some more closely related than others. The focus is on presenting a number of alternative differentiae (often divided dichotomously) and providing examples of animals that possess them. A few instances of correlations among differentiae are noted, and in a few instances additional attention is paid to explicating the meaning of the terms. As in the first section, the differentiae are offered as divisions of some higher genus, but the higher genus is often not named explicitly, and the dividing of any given genus typically does not continue beyond a single level of division.

For example, the first set of differentiae all have to do with what we might call the political or social organization of animals. Aristotle presents the following divisions:¹⁷⁷

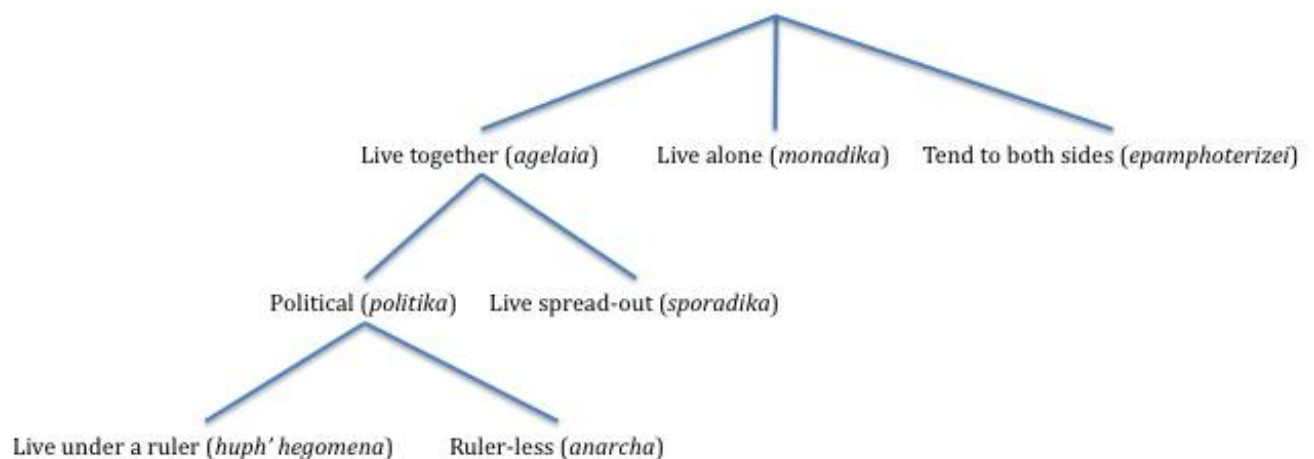


Figure 1: Political and social organization of animals

¹⁷⁷ Discuss emendation to text regarding *agelaia kai monadika*.

Aristotle provides a number of examples of animals that exhibit each differentia,¹⁷⁸ but provides few correlations among them beyond those expressed in the divisions. As an exception, he notes that the distinction *agelaia/monadika* applies equally to footed, winged, and swimming animals. The mention of modes of locomotion here may be to emphasize that these differences in social organization apply throughout the animal world (“air, land, and sea”, as it were), a point that may not be appreciated by someone relatively unfamiliar with the animal world.

The discussion turns immediately from social/political organization to differences in diet and acquisition of food. The relationship between these two discussions is not expounded upon here in *HA*, but a discussion in *Pol.* does expound upon the connection:

[5] But in fact there are many forms of food, which is why there are also many ways of life that belong to animals as well as human beings. For it is not possible to live without food, so that the differences among foods have produced differences among animals. for some of the beasts are in herds, and others scattered, whichever way gives an advantage for their food, since some of them are carnivorous, others herbivorous, and others omnivorous. So it is for convenience and selectivity that nature has made their ways of life distinct, and since the same things are not pleasing to each but different things to different kinds, ways of life among carnivorous and herbivorous animals themselves are divergent from one another. (*Pol.* I.8, 1256a19-29, tr. Sachs)

¹⁷⁸ E.g. *agelaia*: pigeons, cranes, many kinds of fish; *politika*: humans, bees, cranes; *huph' hegemonia*: cranes, bees; *anarcha*: ants

1256a19

ἀλλὰ μὴν εἶδη γε πολλὰ τρο-

φῆς, διὸ καὶ βίοι πολλοὶ καὶ τῶν ζώων καὶ τῶν ἀνθρώπων
εἰσὶν· οὐ γὰρ οἷόν τε ζῆν ἄνευ τροφῆς, ὥστε αἱ διαφοραὶ
τῆς τροφῆς τοὺς βίους πεποιήκασι διαφέροντας τῶν ζώων.
τῶν τε γὰρ θηρίων τὰ μὲν ἀγελαῖα τὰ δὲ σποραδικὰ ἐστίν,
ὅποτέρως συμφέρει πρὸς τὴν τροφήν αὐτοῖς διὰ τὸ τὰ μὲν

a25

ζωοφάγα τὰ δὲ καρποφάγα τὰ δὲ παμφάγα αὐτῶν εἶναι,
ὥστε πρὸς τὰς ῥαστώνας καὶ τὴν αἵρεσιν τὴν τούτων ἢ φύσις τοὺς
βίους αὐτῶν διώρισεν, ἐπεὶ δ' οὐ ταὐτὸ ἐκάστω ἡδὺ κατὰ φύ-
σιν ἀλλὰ ἕτερα ἑτέροις, καὶ αὐτῶν τῶν ζωοφάγων καὶ τῶν
καρποφάγων οἱ βίοι πρὸς ἄλληλα διεστᾶσιν·

In this passage we find many of the differentiae discussed in the *HA* passage,¹⁷⁹ but their relationship is here, in *Pol.*, explicitly laid out in causal terms:¹⁸⁰ the social and political organizations of animals (which Aristotle here associates with their *bios*) vary based on their diets and their ability to obtain their food, and in fact, these social and political organizations

¹⁷⁹ In the *HA* passage, *agelaia* is contrasted with *monadika*, and *politika* and *sporadika* are offered as further divisions of *agelaia*, while in the *Pol.* passage, *agelaia* is immediately contrasted with *sporadika*. This suggests that the divisions in the *HA* passage are more precise or better informed, recognizing that herd animals (*agelaia*) may nonetheless live “spread-out” (*sporadika*). See Balme (forthcoming).

¹⁸⁰ It is important to keep in mind that *Pol.* is a treatise aimed at providing the causes of political phenomena, while the *HA* carefully avoids presenting information couched in causal language. That is not to say that such causal knowledge was unknown at the time of *HA*'s composition, but that if it was known, it was purposefully withheld. But the correlation in *HA* of attributes that are causally related elsewhere suggests that such causal knowledge is not far in the background.

appear to be *for the sake of* obtaining food more easily. It is the animal's distinctive diet that is explanatory (or at least partially so) of the aspects of the animal's *bios* relating to social and political organization. While the discussion of water and land animals above suggested that an animal's *bios* is in some sense explanatory of the various activities performed by the animal, here diet is explanatory of *bios*. But under which category of differentia does diet fall? As with water/land animal, it seems that being a fruit-eater or an all-eater does not designate a particular activity, but rather specifies an aspect of the animal's manner of life that will be determinative of at least some of the animal's activities and, as the *Pol.* passage has it, some other aspects of the animal's manner of life. Thus *diet* would fall under *bios* and, in this case, affect other aspects of *bios* as well.

A passage from *Pol.* may also help explain why differentiae related to voice appear in the *HA* passage under consideration. At *Pol.* I.2, 1253a7-18 Aristotle states:

[6] Why a human being is a political animal, more than every sort of bee and every sort of herd animal, is clear. For nature, as we claim, does nothing in vain, and a human being, alone among the animals, has speech. And while the voice is a sign of pain and pleasure, and belongs also to the other animals on that account (since their nature goes this far, to have a perception of pain and pleasure and communicating these to one another), speech is for disclosing what is advantageous and what is harmful, and so too what is just and what is unjust. For this is distinctive of human beings in relation to the other animals, to be alone in having a perception of good and bad, just and unjust, and the rest, and it is an

is grounded in the increased cognitive abilities found in those animals (namely, their increased power of memory).¹⁸¹ Thus the introduction of the differentiae pertaining to social and political organization may presage those of voice, but the relation seems weak.

Of the remaining differentiae in this section, one may speculate regarding similar connections between them (environment of habitation, frequency of copulation, tendencies to attack in defense), but the emphasis of the passage does not seem to be on identifying such connections, but rather on simply offering a number of examples of different, related features exhibited by animals. Recall that the introductory sentence of this subsection explicitly mentioned manner of life and activity, but did not mention character. Can we detect anything in this discussion that suggests that the differentiae discussed here are less related to character than those in the first subsection? Again, we are hampered in answering this question by the unclarity surrounding these terms, whose meanings, at a higher or more general level, seem clear enough, but whose differences are not obvious. It must be admitted that the many differentiae discussed in this subsection seem to be just as related to an animal's character as those in the first subsection, and, if anything, many appear *more* related. For example, the differentiae related to social and political organization would seem to bear directly on animals' characters (as different social organizations would seem to demand certain character traits). Some of the differentiae discussed in this section, such as tame and wild, are specifically mentioned both in the next subsection and in book VIII (both of which are explicitly related to character). Even though questions remain, it appears more and more likely that we should not read too deeply into the absence of *êthos* in the introductory sentence to this subsection (nor, for that matter, into the presence of *ethos* in the preceding section, nor the absence of *praxis* from the concluding

¹⁸¹ VII.1, 588b30ff.

sentence of the entire section). That being said, it *does* appear that the absence of *bios* and *praxis* from the introductory sentence of the next subsection is meaningful, in so far as the differentiae there described all seem especially relevant to *êthos*.

4.2.3 Character (488b12-28)

4.2.3.1 Summary

According to the introductory sentence to this subsection, the final set of differences pertains to character alone. Typically two or three character traits are presented in a group, together with an example of an animal that exhibits the traits. Often the groups of character traits are presented as if they are opposed to one another, with the first group in some sense opposed to the next. The groups of character traits, with the example animals, are:

<u>Character trait</u>	<u>Animals</u>
gentle, melancholy, and not adversarial <i>(praa, dusthuma, ouk enstatika,)</i>	ox
fierce, adversarial, and stubborn/ignorant <i>(thumôdê, enstatika, amathê)</i>	wild boar
prudent and cowardly <i>(phronima, deila)</i>	deer and hare
mean and scheming	serpents

(analeuthera, epiboula)

noble, brave, and well-born

lion

(eleutheria, andreia, eugenê)

thoroughbred, wild, and scheming

wolf

(gennaia, agria, epiboula)

villainous and wicked

fox

(panourga, kakourga);

spirited, loving, and fawning

dog

(thumika, philêtika, thôpeutika);

gentle and easily-tamed

elephant

(praa, tithasseutika);

bashful and cautious

goose

(aischuntêla, phulaktika)

jealous and vain

peacock

(phthonera, philokaka).

It is specified that humans are the only deliberative (*bouleutikon*) animals and that many other animals exhibit memory (*mnêmê*) and teaching (*didachê*), but only humans have the ability to recollect (*anamimnêskesthai*).¹⁸²

The section ends with a concluding statement that the characters and manners of life of each kind (of animal?) will be discussed in more detail later.

4.2.3.2 Analysis

More so than the previous subsections, this discussion of character is very sparse, limited almost exclusively to offering examples of character traits and animals that exhibit them. Nevertheless certain questions may be raised.

Does Aristotle suggest that these groups of character traits *always* appear together? Or, more generally, what is the relation between the character traits that are presented together? Most of these traits seem to be of a piece with one another, but presumably the various traits are not offered as synonyms but rather as distinct aspects of character. Is it that the animals offered as examples just happen to exhibit the group of traits? Or is there some underlying common cause that renders it more likely that an animal exhibiting one trait also exhibits the other?

Presumably most of the traits mentioned apply to humans as well as animals, but Aristotle's presentation suggests that the character traits are indicative of the animal kinds listed, such that *all* animals of the kind exhibit the traits. And indeed, Aristotle's discussion, in *NE* VI.13 (1044b1-16), of the "natural virtues" suggests that in both humans and many animals¹⁸³

¹⁸² See *DA* II.3, 415a1ff, III.11, 434a4; *Mem.* 1, 450a14ff, 2, 453a6; *Metaph.* A.1, 980a29; *NE* I.7, 1098a3ff, VI.13, 1144b1-16.

¹⁸³ I say "many animals" rather than "all animals" since the extremely limited cognitive capacities of some animals render the appearance of such natural virtues either indiscernible or totally absent. See *HA* VII.1, 588a16-b3.

there exist certain dispositions to act, react, and feel in characteristic ways *by nature*, i.e. in ways that are not learned or habituated.¹⁸⁴ In humans, these dispositions can become virtues (or vices!), based on the development and proper use of practical judgment, a characteristically human cognitive capacity, which is lacking in other animals.¹⁸⁵ Thus in other animals they cannot be “perfected” (or ruined!), and remain (at least for the most part)¹⁸⁶ as they are. This being the case, different kinds of animals reliably exhibit these different traits of character, thus allowing for a scientific study of *êthos* in animals. Aristotle’s intention here is to show that animals do indeed exhibit a great variety of character traits, perhaps more so than the inexperienced observer of animals would expect, and in such a manner as to render them viable subjects of scientific study.

4.3 MOST NECESSARY PARTS OF ANIMALS (488B29-489A34)

4.3.1 Summary

The treatise now turns from the discussion of *bios*, *praxis*, and *êthos* back to the parts of animals. The focus, as Aristotle later summarizes, is on the “most necessary” parts (*anagkaiotata moria*, 489a15).

¹⁸⁴ See Lennox 1999, Leunissen 2013.

¹⁸⁵ Though practical judgment too has its analog in the animal world: cleverness (*deinotês*). See *NE* VI.13, 1044b15, Lennox 1999, pp. 12-6.

¹⁸⁶ Aristotle does allow that some kinds of animals may be habituated in certain limited ways, but lacking any notion of “the good,” and the related cognitive capacities that allow one to direct one’s actions towards the good, such habituation does not result in virtue.

The first group of parts, which *all* animals have in common, include that part by which food is taken in (mouth, *stoma*), and the part into which food is taken (stomach/belly/gut, *koilia*). Next are parts that *most* animals possess. These include the parts by which residue is discharged (unnamed), and those into which residue is received. Fluid residue is received by the bladder (*kustis*), solid residue by the stomach/gut/belly (*koilia*). Finally, *most* animals have parts by which *sperma* is emitted. These parts go unnamed here, but Aristotle draws the distinction between animals that emit *sperma* into themselves (females) and those that emit into another (male).¹⁸⁷

The discussion of “most necessary” parts continues with a discussion of the parts related to the faculty of touch – the single faculty of sensation shared by all animals. After stating that the part in which the faculty is located has no single name common to all animals, and that in some animals the part is the same while in others it is analogous, Aristotle turns to a discussion of the fluids present in animals (e.g. blood) and the associated parts that act as containers for the fluid (e.g. blood vessel). The connection between the discussions follows immediately: touch comes about in a uniform part that is well-supplied with whatever fluid is present in the animal. In blooded animals this is the flesh (*sarx*); in others it is the analogous uniform part. This leads to the distinction between blooded (*enaima*) and bloodless (*anaima*) animals.

4.3.2 Analysis

Although Aristotle ultimately refers to the parts in question in this section as the “most necessary parts,” he begins by merely noting which parts are “common” (*koina*) to all or most

¹⁸⁷ On which see *GA* I.2, 716a17-24.

animals. He isolates these parts by identifying the *functions* or *activities* they perform, and indeed the activities discussed (nutrition, generation, sensation) are among the most vital performed by animals.¹⁸⁸ This suggests that the commonality of these parts is grounded in their corresponding vital functions, as is their status as “most necessary.

What is interesting about this manner of presentation is that the subsequent treatment of the parts of animals in books I-IV does not use commonality, strictly speaking, as a principle of organization, nor vital function. Rather Aristotle uses the human body¹⁸⁹ to develop a basic framework of parts (for the external parts, these include the head, neck, torso, and limbs) that are then used to analyze the bodies and parts of other animals (e.g. other animals share these parts, lack some of these parts, have analogous parts, etc.). Mention is not made regarding how *just these parts* are identified for use in this framework, but the sense is that, for the external parts at least, the ones identified *stand out to perception* as being unified wholes in humans, without reference to the functions they perform being necessary.

The issue is of significance given the explanatory relationship that holds between a part and its corresponding function. As discussed at length in *PA* I, a part is generally present in an animal *for the sake of* the function it performs, such that the function explains the presence of the part.¹⁹⁰ Descriptions of parts that make reference to the functions they perform would therefore, at the least, gesture towards the explanations of why such parts are differentiated as they are (i.e. due to difference in function). To a large extent, the discussions of parts in *HA* are not centered

¹⁸⁸ VII.1 on nutrition and generation; sensation as common to all animals.

¹⁸⁹ And indeed moves from top to bottom, beginning with the head. A similar order is found in the treatment of parts in *PA*.

¹⁹⁰ However, some of the attributes associated with parts may not be for the sake of anything, e.g. color of eyes, hair, etc. See *GA* V for a discussion of such *pathêma* (*GA* V.1, 778a16).

around the functions they perform,¹⁹¹ nor is reference often made to these functions, such that most of these discussions do not carry with them this sort of hint at explanation. Why then does the *tupos* proceed in this manner?

At issue is whether the *introduction* to the discussion of parts should proceed in a different manner than the main body of that discussion, and if so, why. As discussed above, the goal of this section is to introduce the reader to the most common parts shared by animals (either all or most), and these are the parts that fulfill the most common (indeed most necessary) functions in an animal's life. The alternate method of presentation, the one followed by the body of the treatise, is to set up a model, as it were, of the parts of animals, and compare various kinds of animals to this model, noting where they are similar and where different. The power of this alternate method lies in either the familiarity the reader/student has of the model, or in the model's broad applicability to a wide range of animals. In the first case, the familiarity with the model serves to lead the reader/student from what is well-known, to what is less well-known, a common and effective means of teaching; while in the second case, the wide applicability of the model renders it a good example of how animal bodies are generally structured, and thus serves to indicate which parts they generally have. The method followed here in the *tupos* (viz. beginning with vital activities/functions) in effect provides a sort of justification of explanation of why the model used in the alternate method is structured as it is, or includes the parts that it does.

Similar lists of the most necessary or common parts of animals appear elsewhere in the corpus. At *PA* II.10 Aristotle states:

¹⁹¹ And indeed Aristotle often seems to consciously *avoid* references to function, e.g. avoiding words like "respiration" that might imply function, and preferring instead locutions such as "taking in and expelling."

[7] Two most necessary (*anagkaiotata*) parts possessed by all complete animals are, first, that by which they take in nutriment and, second, that by which residue is emitted; for it is not possible to exist or to grow without nutriment . . . A third part in all [animals] is the part between those two, in which is the source of life (*archê* . . . *tês zôês*). (*PA* II.10, 655b29-32, 36-7)

655b29 Πᾶσι γὰρ τοῖς ζώοις τοῖς τε-
 λείοις δύο τὰ ἀναγκαιότατα μέρη ἐστίν, ἧ τε δέχονται
 τὴν τροφήν καὶ ἧ τὸ περίττωμα ἀφήσουσιν· οὔτε γὰρ εἶναι
 οὔτε αὐξάνεσθαι ἐνδέχεται ἄνευ τροφῆς . . .

b36 . . . Τρίτον δὲ μέρος ἐν πᾶσιν ἐστὶ τὸ τούτων μέσον,
 ἐν ᾧ ἡ ἀρχὴ ἐστίν ἢ τῆς ζωῆς.

And in *Juv.* 2 we find:

[8] There being three parts into which all complete animals are divided, one is that by which nutriment is taken in, another is that by which residue is excreted, and the third is between these. In the largest animals this is called the chest, in the others it is the analogue, being better distinguished in some rather than others. (*Juv.* 2, 468a13-7)

468a13 Τριῶν δὲ μερῶν ὄντων εἰς ἃ διαιρεῖται πάντα τὰ τέ-
 λεια τῶν ζώων, ἐνὸς μὲν ἧ δέχεται τὴν τροφήν, ἐνὸς δ' ἧ
 a15 τὸ περίττωμα προίεται, τρίτου δὲ τοῦ μέσου τούτων, τοῦτο ἐν
 μὲν τοῖς μεγίστοις τῶν ζώων καλεῖται στήθος, ἐν δὲ τοῖς ἄλ-
 λοις τὸ ἀνάλογον, διήρθρωται δὲ μᾶλλον ἑτέροις ἑτέρων.

The *HA* passage differs from these in so far as (1) it specifies not only the part by which nutriment is taken in, but also the part into which it is taken; (2) it points out that not *all* animals possess a part by which residue is expelled; and (3) it fails to list the part between these two parts as a most necessary part. Regarding (1), *HA* is more precise in specifying that all animals have both a part by which nutriment is taken in (mouth) and into which it is taken (stomach), but the sense from passages [7] and [8] is that the parts are being identified in order to provide a basic division of the animal body, and thus are not meant to be exhaustive. Regarding (2), the fact that some animals do not emit residue is mentioned also in *PA* (e.g. 681a32), and thus was not unknown to Aristotle at the time of its composition. Rather, the emphasis in [7] (as well as [8]), is on *complete* animals, something that the animals lacking a part to emit residue definitively are not.¹⁹² Regarding (3), it is curious that the *HA* passage does not include a reference to the main body of the animal or, more precisely, the region containing the heart (which is the “source of life” referred to in the *PA* passage). Balme suggests that this is in keeping with *HA*’s avowed pre-causal, pre-explanatory aims,¹⁹³ however it seems more likely that, in [7] and [8], Aristotle is in effect *dividing* the entire bulk of an animal’s body into three parts (i.e. the end in which food is

¹⁹² In fact, the animal in question at 681a32, the ascidian, is called “plant-like” (*phutô paraplêson*) by Aristotle there, such that there is some doubt whether it is an *animal* at all.

¹⁹³ Balme (forthcoming).

taken in, the end in which residue is expelled, and that which comes in between), while in the *HA* passage he is *picking out* certain, distinct parts that are most common. This would also explain the absence of reference to the generative parts in [7] and [8], which are mentioned in the *HA* passage. These parts are clearly present in all “complete” animals, but do not occupy a significant portion of the animal body.

Following the brief discussion of generative parts, Aristotle appears to conclude the discussion of the most necessary parts with the summarizing statement: “Thus as many of the parts that are most necessary for animals, those that all (animals) happen to have, and those that most do, are these” (489a16). However, immediately following is a discussion of touch – the faculty of sensation that is common to all animals – and the statement that the part in which the faculty of touch resides is unnamed, being the same part in some animals, but analogous in others. Since the faculty is present in *all* animals, there must be a part in which the faculty resides,¹⁹⁴ and that part, named or not, would appear to be a *most necessary part*. Similarly for the discussion of fluid and the parts associated with fluid that immediately comes next: *all* animals contain fluid, and thus, according to Aristotle, all animals have parts to contain the fluid, whether it is blood and blood vessels or their analogues. These too seem to be most necessary parts. We immediately see the relationship between the discussions of the faculty of touch and the fluid parts: touch, Aristotle states, resides in a uniform part that is typically well-supplied with fluid (e.g. flesh, which is well-supplied with blood).

The discussion of fluid leads to the final observation regarding most necessary parts, namely that some animals are blooded while others are bloodless. Being “bloodless” according

¹⁹⁴ Though, infamously, Aristotle holds that *nous* does not reside in a part. See *DA* III.4, 429a25.

to Aristotle means possessing a fluid part that is other than, though analogous to, blood. Thus we need not take the differentia *bloodless* as merely a privation. This distinction is perhaps the most important for Aristotle's biology, and typically is used as a high-level organizing principle in discussions of animals. Aristotle specifies that all footless, two-footed, or four-footed animals are blooded, while all many-footed animals are bloodless. This correlation, which suggests an underlying causal relationship, is expounded upon elsewhere in the corpus.¹⁹⁵

4.4 MODES OF REPRODUCTION (489A34-B18)

4.4.1 Summary

The discussion now turns to the differences animals exhibit with regard to generation and reproduction. The primary divisions introduced are live-bearing (*zôotoka*), egg-bearing (*ôotoka*), and larva-bearing (*skôlêkotoka*). It is noted that some live-bearing animals are internally egg-bearing, while others are internally live-bearing. The differences between an egg (*ôon*) and a larva (*skôlêx*) are discussed, as well as differences between eggs of different kinds of animals. The stretch of text ends with the following passage: "But about these things we shall speak later with precision in the writings on generation (*en tois peri geneseôs*)" (489b18). Examples of animals that exhibit each of the characteristics discussed are provided.

¹⁹⁵ *IA* 1, 5, 16, etc.

4.4.2 Analysis

Of the three primary modes of reproduction (live-bearing, egg-bearing, and larva-bearing) live-bearing and egg-bearing take on the greatest significance, both in *HA* and elsewhere in the biology. (This is perhaps because relatively few animals are larva-bearing).

The examples Aristotle provides of animals that are live-bearing animals are interesting. First, he divides the examples between land-dwelling and water-dwelling animals, and second the land-dwelling examples include not only certain specific animal kinds (e.g. human, horse, seal), but also animals marked off by possessing a certain trait – in this case, possessing hair. This correlation is perhaps meant to suggest a causal relationship, or perhaps an underlying common cause.

In addition to describing them, Aristotle also provides certain differentia applicable to egg or larva: eggs are potshard-skinned (*ostrakoderma*) or may have soft skin (*malakoderma*),¹⁹⁶ and their contents may be of one color or two; some larva are able to move (*kinêtikos*) straight away, others are not.

The concluding statement in this section – that these matters will be discussed later with precision in the works on generation – does not make clear whether the reference is to the further discussions of reproduction in *HA* or to the explanatory treatise *GA*.¹⁹⁷ This brief discussion of the modes of reproduction in animals does not do justice to the especially rich discussions of reproduction and generation in books V, VI, and IX. In those books we find extended discussions

¹⁹⁶ Note that these adjectives are closely related to the descriptive names Aristotle gives to two of the bloodless *megista gênê* of animals, namely the *ostrakoderma* and the *malakia*.

¹⁹⁷ Generally the discussion is related more closely to *GA* I.1-15.

of mating habits, seasons of breeding, brood care, modes of copulation, etc., as well as much more detailed discussions of eggs and the formation of embryos in eggs.

4.5 PARTS RELATED TO LOCOMOTION (489B19-490B6)

4.5.1 Summary

The discussion next turns to the different parts associated with differing modes of animal locomotion. The information is presented as if derived from a set of divisions. The broad organization is around three primary modes of locomotion: moving on land, swimming, and flying, and each of these is then divided according to the parts that the corresponding animals possess:

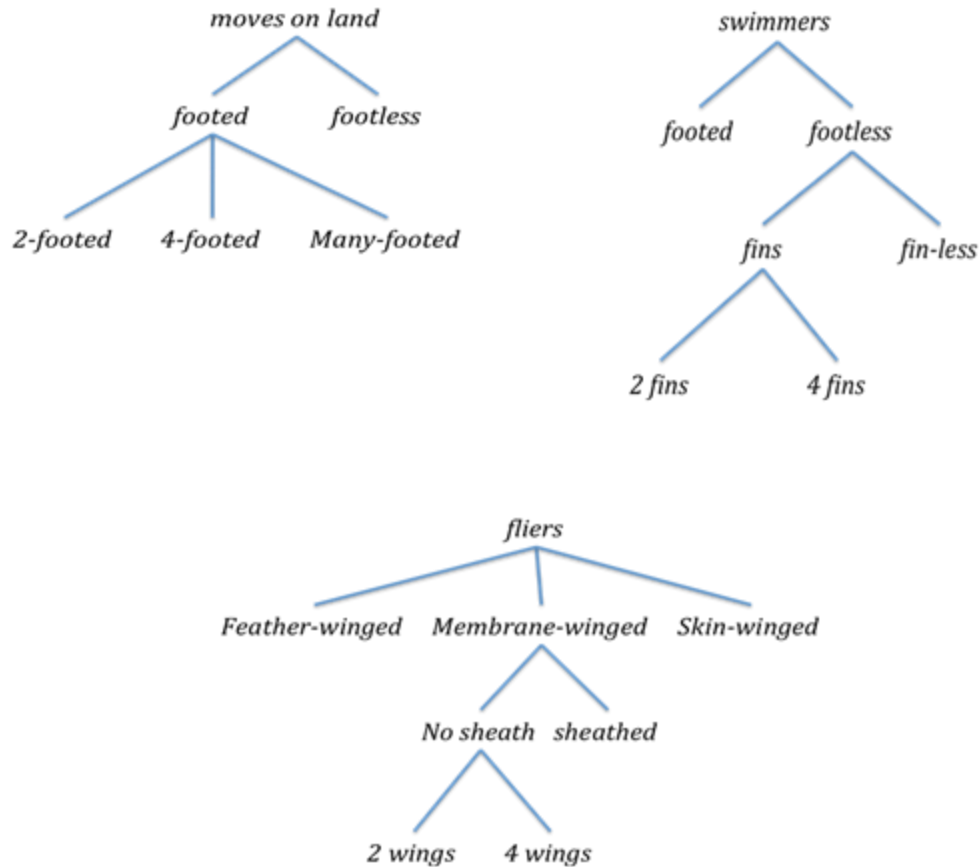


Figure 2: Parts associated with locomotion

Again, specific kinds of animals that exhibit the features discussed are offered as examples. Some additional correlations are provided, e.g. all blooded fliers have either feather or skin wings, only bloodless fliers have membrane wings; skin-winged bloodless fliers with four wings either are large or have a sting at the rear, those with two wings either are small or have a sting in the front. The end of the passage offers some general remarks on animal locomotion, namely that all animals move with four or more points of motion, and that all move “diagonally” (*kata diametron*).

4.5.2 Analysis

This section, focused as it is on the parts associated with a function or activity that is “vital” for most animals (though, as the earlier discussion of *monima* exhibited, not all), fits well with the earlier discussion of the “most necessary” parts, and continues the pattern of using a vital function to introduce certain parts. The emphasis is on the kinds and number of parts animals use in the service of locomotion, and how for each mode of locomotion, the number of such parts can differ among animals kinds. Certain key features of animal locomotion that are expounded upon in *IA* are offered here (all animals, regardless of the number of limbs or parts associated with locomotion they possess, move with at least four points of motion, blooded with four, bloodless with more; all footed animals move diagonally). The purpose is perhaps to show that even animals that share a common mode of locomotion may possess different parts(or at least, different *numbers* of parts) to do so.

4.6 *MEGISTA GENÊ* (490B7-491A6)

In this important chapter Aristotle discusses the “very large kinds” (*megista genê*) into which most animals may be classified. The argument presented in the passage is difficult to follow, and its conclusion is debated.¹⁹⁸ I have included my own close analysis of the passage in appendix 3 below. In summary, I argue that the passage (1) introduces the *megista genê* and provides examples to help the reader identify just which animals are being referred to; (2) argues

¹⁹⁸ See Gotthelf 2012c, Stoyles 2012.

that there are no further very large kinds, and explicitly excludes four-footed live-bearing animals, a group commonly identified by scholars as an Aristotelian *megiston genos*. The argument is meant to show that the animals that would be grouped into the putative very large kind would exhibit differences that are too divergent, failing a standard (laid out in PA I.4, of forms of a kind being not too far apart. This in turn points to the purpose of discussing the *megista genê* here in the *tupos*, namely that the commonality exhibited by the differing forms of animals under a single *megiston genos* allows us to speak of those forms of animals at that higher, *genos*-level, and thus to avoid being unnecessarily repetitious in the presentation.

4.7 METHODOLOGICAL REFLECTION (491A7-14)

Following the discussion of the *megista gene*, Aristotle concludes the introductory *tupos* with a reflection on the methodology that is to be used in the rest of the treatise. It is perhaps the most important such passage in the entire work. In the first chapter of the dissertation I briefly discussed this passage in order to bring to light certain “clues” it provides regarding the purpose and methodology of a *historia* that were then used to develop the notion of *historia* based on passages from other treatises in the corpus. In what follows below, I provide a closer interpretation of the passage itself.

In its entirety, the passage reads as follows:

- [9] (1) These things have now been said in this way as an outline, for the sake of a taste of what sort and how many things must be studied; (2) we shall speak with precision later, in order that we should first grasp the existing differences and

attributes for all. (3) After this we must attempt to discover the causes of these; (4) for this is the natural way to conduct the investigation, there being a *historia* regarding each thing. (5) For both the about-which-things and the from-which-things that demonstration must be comes to be clear from these things.

491a7 (1) Ταῦτα μὲν οὖν τοῦτον τὸν τρόπον εἴρηται νῦν ὥς ἐν
τύπῳ, γεύματος χάριν περὶ ὅσων καὶ ὅσα θεωρητέον· δι'
ἀκριβείας δ' ὕστερον ἐροῦμεν, (2) ἵνα πρῶτον τὰς ὑπαρχούσας
a10 διαφορὰς καὶ τὰ συμβεβηκότα πᾶσι λαμβάνωμεν. (3) Μετὰ δὲ
τοῦτο τὰς αἰτίας τούτων πειρατέον εὑρεῖν. (4) Οὕτω γὰρ κατὰ φύ-
σιν ἐστὶ ποιεῖσθαι τὴν μέθοδον, ὑπαρχούσης τῆς ἱστορίας τῆς
περὶ ἕκαστον· (5) περὶ ὧν τε γὰρ καὶ ἐξ ὧν εἶναι δεῖ τὴν ἀπό-
δειξιν, ἐκ τούτων γίνεται φανερόν.

A number of points are made in this passage, some of which are obscured by the use of pronouns whose antecedents are not immediately clear. I have divided the passage into five parts, each of which I analyze below.

(1) These things have now been said in this way as an outline, for the sake of a taste of what sort and how many things must be studied;

491a7 Ταῦτα μὲν οὖν τοῦτον τὸν τρόπον εἴρηται νῦν ὥς ἐν
τύπῳ, γεύματος χάριν περὶ ὅσων καὶ ὅσα θεωρητέον·

The sense in which the preceding discussion acts as a *tupos* of the treatise that follows, and the precise sense we can associate with *touton ton tropon*, is the subject of this chapter, and concluding reflections on this matter are offered below. The use of the genitive *hosôn* and accusative *hosa* with *peri* in a8 indicates that the preceding discussion has touched on both the number of different topics and the kinds of things to be discussed,¹⁹⁹ and is probably meant to convey the *completeness* of the *tupos*.

(2) we shall speak with precision later, in order that we should first grasp the existing differences and attributes for all.

δι’

491a9 ἀκριβείας δ’ ὕστερον ἐροῦμεν, ἵνα πρῶτον τὰς ὑπαρχούσας
διαφορὰς καὶ τὰ συμβεβηκότα πᾶσι λαμβάνωμεν.

The reference to speaking with “precision” (*akribēia*) later indicates that, in any event, the foregoing discussion has been less precise than what will follow. This may include providing greater detail, making fine-grain distinctions, treating a wider range of subjects, etc. The goal of these later, more precise discussions will be to “grasp the existing differences and attributes for all”, but “all” what? Presumably all *animals*: the goal (or perhaps a goal) of the *historia* is to

¹⁹⁹ Smyth, 1693.1.b, 3.b.

catalogue, as it were, all the attributes and differences exhibited by animals.²⁰⁰ The explicit mention of both *diaphora* and *sumbebêkota* may be to emphasize that the *historia* is not only concerned with the *differences* between animals, but also, more generally, with the features that animals exhibit. This may especially be the case if, by *diaphora*, Aristotle means (or “hears”) something like *specific difference*, i.e. the difference that marks off an *eidos* from a *genos*. While such differences may be of interest, they are not the sole focus of the enterprise. Indeed, if the line of interpretation that holds that Aristotle is not interested in forming a classification of animals in *HA* (one that I traced back to Balme in ch. 1, and that I seek to align myself with) then this technical sense of *diaphora* is not at work here.

What’s the force of the participle *huparchousas* in the phrase *tas huparchousas diaphoras*? The emphasis seems to be on the actual differences that animals are observed to exhibit. For example, not only should we note that birds possess beaks, but also that beaks themselves are differentiated in many ways (long, short, straight, curved, etc.) since the actual beaks that birds possess come in these varieties. The later, more detailed discussion should provide us with a grasp of the full range and variety of differences exhibited in the animal world.

What sort of cognitive state is implied by “grasping” (*lambanein*)? Given that in (3) there is mention of attempting to discover causes later, Aristotle presumably means by “grasping” a “knowing that” rather than a “knowing why”, but exactly what does this amount to? Further, what is it that is “grasped”? Is it the fact that certain animals possess certain attributes? Or, does a full survey of the range of differences exhibited by e.g. a certain kind of part provide us with a

²⁰⁰ Is there a difference between grasping (i) *all the attributes and differences* of animals and (ii) the attributes and differences of *all animals*? Reading (i) puts the emphasis on the attributes and differences, while (ii) puts the emphasis on the animals (i.e. the different kinds of animals). As such I favor (i), but beyond a difference in emphasis, I’m not sure there is a real difference in extension.

fuller, better, “grasp” of the part itself, i.e. an understanding of just what each part is, apart from knowing which animal’s possess the part? The latter seems to be correct, since, as Balme memorably stated, the animals appear to be “called in as witnesses” to the differentiae. The predication of the difference to the animal appears to be of secondary concern compared to the elucidation of just what the difference is, and mention of the animal seems to be in the service of this latter concern.

(3) After this we must attempt to discover the causes of these;

491a10

Μετὰ δὲ

τοῦτο τὰς αἰτίας τούτων πειρατέον εὑρεῖν.

This methodological recommendation – first establish the facts, then discover the causes – is repeated in various forms throughout the corpus , and is discussed at some length in the first chapter of the dissertation. The antecedent of *toutôn* at 491a11 is presumably the differences and attributes, such that the investigation is into the causes of *these differences and attributes*. Again, the emphasis of the *historia* is on the differentiae, not the animals that exhibit them.

(4) for this is the natural way to conduct the investigation, there being a *historia* regarding each thing.

491a11

Οὕτω γὰρ κατὰ φύ-

σιν ἐστὶ ποιεῖσθαι τὴν μέθοδον, ὑπαρχούσης τῆς ἱστορίας τῆς

περὶ ἑκάστων·

The point here is not that this method of investigation is specific to the study of nature, but rather that it is the *proper* or *fitting* way to conduct an investigation, whether it is about nature or not.

The sense of the genitive absolute clause with *huparchousês* is this: “when” or “in the case that” a *historia* about each is *completed* (i.e. is *there before us*), then and only then is it fitting to attempt to seek out the causes. But what is the antecedent of *hekaston* in a13 – a *historia* about each *what*? One is tempted to supply “animal” here. Afterall the treatise is a *historia peri zôôn*, but of course the word “animal” does not appear anywhere in the passage. The emphasis on attributes earlier in the passage may indicate that the antecedent should be *ta diaphora kai ta sumbebêkota*. But, as I discussed earlier, the differences between a *historia* of animals, and one of their attributes, begins to break down when we consider that when one studies animals, what one is primarily concerned with is the attributes exhibited by those animals.

(5) For both the about-which-things and the from-which-things that demonstration must be comes to be clear from these things.

491a13 περὶ ὧν τε γὰρ καὶ ἐξ ὧν εἶναι δεῖ τὴν ἀπό-
δειξιν, ἐκ τούτων γίνεται φανερόν.

The language here, as has been often pointed out,²⁰¹ is that of the *Analytics*. *Apodeixis* is of course Aristotle's term for "demonstration" or "scientific demonstration". The *peri hôn* or "about which things" are the conclusions of demonstration, and the *ex hôn*, or "from which things" are the premises. Both "come to be clear from these things" – that is, from our grasp of the attributes belonging to animals, or in other words, from the *historia*. In order to explain why a given animal possesses a given attribute (a fact that is established in the *historia*), we must identify the causal feature belonging to that animal that is responsible for the presence of that attribute. But, according to this passage, establishing the presence of that causal feature itself will be accomplished in the *historia*, in so far as the *historia* provides us with the premises. But as is well known, the premises of an apodeictic demonstration are themselves indemonstrable; they are the "unmiddled" propositions that form the *archai* of a science. The most important of these are the definitional propositions that state the essence of a subject or predicate: in this sense *apodeixis* is "essence invoking".

Readers of the *Analytics* are well-familiar with the many difficulties involved in Aristotle's discussions of exactly how we come to know the *archai* of a science. What's interesting here is that Aristotle draws no distinction between our coming to know the fact that a given conclusion holds prior to knowing the reason why (the *hoti* before the *dioti*) and our coming to know the *archai* or premises of a demonstration. Perhaps we come to know that such a fact holds prior to knowing that it is an *archê* – we grasp the fact of the premise without knowing that it functions as a premise or a conclusion.

²⁰¹ See e.g. Kullmann 1974, p. 261ff., 2007, p. 197; Lennox 1991, p. 45. See also Barnes 1993, pp. xix-xx for a more cautious view.

4.8 CONCLUSION

We are now in a better position to understand just what Aristotle means when he writes, in the methodological passage in I.6, that “*these things* have been said *in this way* as an outline.” The forgoing has shown that the *tupos* does provide an outline of sorts of the material that follows in the rest of the treatise. This is especially true of I.1, which discussed all four major forms of differentia to be treated, and to a degree tracks the discussions in the ensuing books. Further, the examples of actual differentiae that are given in each category match up well with those discussed in the main body of the treatise. Occasionally Aristotle mentions differences that are not subsequently discussed, but this is more the exception than the rule. More often we find simply a briefer treatment of topics that are expounded upon “with precision” later, as with e.g. the corresponding discussions of water and land animals in I.1 and VII.2.

The discussion of the “most necessary parts” that follows the survey of differentiae in I.1 serves to introduce the reader to those parts that are most commonly found across the animal world, and the use of vital function or activity to introduce these parts gestures towards the explanatory relationship that holds between parts and activities. In this way the reader is provided with a sense not only of which parts are typically found, but also why these parts are shared by so many different kinds of animals. Though this does not strictly serve the purposes of the *historia*, in so far as it goes beyond collecting, organizing, and elucidating the data pertaining to the parts of animals, as a method of introduction it better situates and prepares the reader for the many details that follow.

The brief discussion of the differentia associated with generation and reproduction interrupts, as it were, the discussion of parts that are commonly found in animals, as immediately following it is the discussion of the parts resumes with those associated with locomotion –

another vital activity that is shared by most animals. One might have expected here a discussion of the *parts* associated with reproduction, but what we get instead is only the briefest of summaries of the primary differentia associated with reproduction (e.g. live-bearing, egg-bearing, larva-bearing). The importance, however, of generation and reproductive activities in an animal's life requires that the introductory *tupos* at the very least touch on these matters. That this discussion does not appear anywhere in the long discussion of *bios*, *praxis*, and *êthos* in I.1 is odd, since, as Aristotle states later, the activities surrounding reproduction, along with those associated with the gathering of food and nutrition, occupy almost all of an animal's time and energy.

The rather puzzling discussion of the *megista genê* in I.6, with its confusing argument regarding the precise number of *genê* that are *megista*, serves nonetheless to introduce the reader to the very large kinds of animals that will be used throughout the treatise as organizing principles, responsible (in part) for structuring the discussions of the various kinds of differentiae. These kinds can operate in this manner due to the similarities that exist between the forms of animals falling under them, since such forms differ only by "the more and the less," as is specified in the typology of sameness and difference.

Finally, the methodological passage with which the introductory *tupos* ends situates the project of the *historia* within the broader explanatory project embodied by the *epistêmê* of animals.

In effect, Aristotle has provided an introduction that both outlines the rest of the treatise, and provides a more theoretical discussion of concepts and points of method that will play crucial roles in what follows. The focus is not so much on identifying *which animals* exhibit the differentiae under consideration, as it is on *the differentiae themselves* – laying out the various

kinds and sub-kinds of features, identifying important forms of these kinds, describing and clarifying the meanings of the terms used, and providing examples of animals that exhibit them.

5.0 EXAMINATION OF SELECT PASSAGES FROM *HA*

In this chapter I analyze select passages from the *HA* itself. The goals of this chapter are to provide a brief overview of the contents of each of the three main sections of the *HA*, and to analyze select passages from each of these sections in order to illustrate the manner in which the content is presented and to make connections with the more theoretical discussions of *historia* presented above.

In section (2) I focus on the discussions of the parts of animals in *HA* (I.7-IV.7). Section (3) is devoted to the discussions of generation and reproductive practiced in *HA* V-VI and IX, and section (4) focuses on *HA* VII-VIII, which, broadly speaking, discusses differences in feeding, constitutional health, and character.

5.1 *HA* I.7-IV.7: ON THE PARTS OF ANIMALS

Aristotle begins his study of the similarities and differences among animals by looking at their parts, the first of the four major differentiae discussed in the introductory *tupos*. The four books dedicated to this pursuit are organized as follows:

Book I.7-17: external and internal non-uniform parts of humans

Book II: external and internal non-uniform parts of other blooded animals

Book III.1: generative parts of blooded animals (sometimes external,
sometimes internal)

Book III.2-22: uniform parts of blooded animals

Book IV.1-7: parts of bloodless animals

Each of these discussions are structured around certain organizing principles. I will focus my discussion on Aristotle's treatment of the non-uniform parts of animals, with emphasis on the external parts. In section (2.1) I discuss the reasons Aristotle gives for beginning with *parts*, and specifically *human parts*. This discussion leads to a more general reflection on the aim of a *historia* as providing a detailed, precise account in words of the differences exhibited by animals. In section (2.2) I consider the organizing principles that structure these discussions, and the reasoning behind them. Specifically I focus on the discussion of the external parts of blooded animals, using the discussion of the parts of birds as an example. Finally in section (2.3) I provide a reflection on the discussion of parts in *HA*.

5.1.1 Preliminary considerations

5.1.1.1 Why begin with the *parts* of animals?

What justification does Aristotle offer for beginning the *historia* with the parts of animals, as opposed to one of the other differentiae? By way of introducing this section, Aristotle states:

[1] We must first consider the parts of animals from which they have been composed.

For according to these, first and most, the wholes differ also, either in so far as

some have [a part] and some do not, or by position or arrangement, or also according to the differences mentioned earlier, by form and excess and analogy and opposition of affections. (*HA* I.6, 491a14-a19)

Ληπτέον δὲ πρῶτον τὰ

491a15 μέρη τῶν ζώων ἐξ ὧν συνέστηκεν. Κατὰ γὰρ ταῦτα μάλιστα
καὶ πρῶτα διαφέρει καὶ τὰ ὅλα, ἢ τῷ τὰ μὲν ἔχειν τὰ
δὲ μὴ ἔχειν, ἢ τῇ θέσει καὶ τῇ τάξει, ἢ καὶ κατὰ τὰς
εἰρημένας πρότερον διαφοράς, εἶδει καὶ ὑπεροχῇ καὶ ἀνα-
λογία καὶ τῶν παθημάτων ἐναντιότητι.

Aristotle claims that the *historia* should begin with the differences exhibited by the parts of animals because “the wholes” (i.e. whole animals) also differ mainly by the parts out of which they are composed. The point seems to be that not only do the *parts* of one kind of animal differ from another, but also the *whole bodies* of different kinds of animals differ in recognizable ways.²⁰² And while these *whole body* differences are primarily a product of differences among the external parts, an important distinction is made. On the one hand, the same part, as it appears in two different kinds of animals, may exhibit certain differences (e.g. the wings of two different

²⁰² This same relation between the parts of animals and their whole bodies is used in the introductory *tupos* in the discussion of the manners of sameness and difference that exist between animals. There, at 486a20, Aristotle states that animals that are the same in form have their parts the same in form as well, since “just as the whole is to the whole, similarly each of the parts is to each” (*homoiôs gar hôsper to holon echei pros to holon, kai tôn moriôn echei hekaston pros hekaston*). The point there was that we recognize certain whole animals as being the same in form, and for those animals, their parts are also the same in form, due to the proportional relationship of the whole to the part.

A similar statement appears in *Parts of Animals* I.4, where the context regards the grouping of animals into kinds:

644b7 Σχεδὸν δὲ τοῖς σχήμασι
τῶν μορίων καὶ τοῦ σώματος ὅλου, ἐὰν ὁμοιότητα ἔχωσιν,
ῥρίσται τὰ γένη, οἷον τὸ τῶν ὀρνίθων γένος πρὸς αὐτὰ πέ-
b10 πονθε καὶ τὸ τῶν ἰχθύων καὶ τὰ μαλάκιά τε καὶ τὰ ὀ-

²⁰⁴ Tr. Lennox 2001a.

στρεια. Τὰ γὰρ μέρη διαφέρουσι τούτων οὐ τῇ ἀνάλογον ὁμοι-
 ότητι, οἷον ἐν ἀνθρώπῳ καὶ ἰχθύϊ πέπονθεν ὁστοῦν πρὸς ἄκαν-
 θαν, ἀλλὰ μᾶλλον τοῖς σωματικοῖς πάθεσιν, οἷον μεγέθει
 μικρότητι, μαλακότητι σκληρότητι, λειότητι τραχύτητι
 b15 καὶ τοῖς τοιούτοις, ὅλως δὲ τῷ μᾶλλον καὶ ἥττον.²⁰⁵

Here again Aristotle makes the distinction between the *parts* of an animal and its *whole body*. We recognize similarities and differences between animals at both levels, but our initial grasp of the animal is through our perception of the whole body and its general shape and form.²⁰⁶ However the shape and form of an animal's whole body is the product of the shape and form of the external parts making up the body: differences in these parts can lead to differences in the whole.²⁰⁷ When we recognize differences between animals at this more general level, we may “look closer,” as it were, and see that these differences are due to differences among the parts making up the animals' bodies. The *historia* begins by studying the parts of animals because it is through our grasp of these parts that we first come to identify the differences perceived in the whole animal.²⁰⁸ The remaining categories of difference – manners of life, activities, and

²⁰⁵ The Greek text is from Louis (1956).

²⁰⁶ See, e.g. the discussion in *Phys.* I.1 on the manner in which our initial perception is of a poorly differentiated whole that is later analyzed into parts.

²⁰⁷ Certain part differences are unlikely to lead to dramatic differences in the whole body. As Aristotle notes in passage [2], animals whose parts are similar to one another by analogy only (such as the wings of a bird and the fins of a fish) have been divided into different kinds, presumably because these differences lead to recognizable whole body differences.

²⁰⁸ As Balme points out (forthcoming, *ad loc.*) Aristotle does not state here that animals differ *solely* by their parts, but the sense is that the differences most present and observable by us reside in the parts. Our first access to animals, as it were, is by means of our perception both of their bodies as wholes, and of the parts making up their bodies.

characters – will *ultimately* play an important role in the study of animals, especially in so far as the parts will be explained primarily by the functions they perform, and these functions will be grasped by observing the *activities* and, in general, the different *manners of life* exhibited by animals. However, our first grasp or understanding of animals comes through our perception of their bodies and the parts out of which their bodies are composed, and thus it is here, Aristotle argues, that the investigation should begin.

5.1.1.2 Why begin with the parts of *humans*?

Having argued that the study of the differences between animals should begin with their parts, Aristotle next claims that the study of the parts should begin with those of humans:

[3] But first the parts of humans must be considered; for just as each²⁰⁹ reckons currency with reference to that which is most familiar to itself, clearly also the same holds in other matters; but among animals man is of necessity the most familiar to us. (*HA* I.6, 491a19-a23)

Πρῶτον δὲ τὰ τοῦ

491a20 ἀνθρώπου μέρη ληπτέον· ὥσπερ γὰρ τὰ νομίσματα πρὸς
τὸ αὐτοῖς ἕκαστοι γνωριμώτατον δοκιμάζουσιν, οὕτω δὴ καὶ
ἐν τοῖς ἄλλοις· ὁ δ' ἄνθρωπος τῶν ζώων γνωριμώτατον ἡμῖν
ἐξ ἀνάγκης ἐστίν.

²⁰⁹ The antecedent of “each” here is unnamed. It may be “nation” (as Peck (1965) translates), or “city-state” (as I suggest below), or it may simply be a reference to the one responsible for reckoning currency – the *dokimastês*. See Buttrey’s article in Thomson 1979, pp. 33-45.

The reference to reckoning currency implies that we come to know or better understand something new or “foreign” by comparison with something familiar. Just as in Greek city-states an official would determine the value of foreign currency in terms of the local one, so also the parts of other animals come to be better known by means of a comparison with the parts of humans: we begin with what is most familiar and best known (*gnôrimôtaton*) to us, and the parts of humans are, as Aristotle says, “of necessity” best known to us,²¹⁰ presumably because we are human, and thus we are most intimately familiar with the human body.²¹¹

The methodological prescription of beginning an investigation with what is more familiar or better known is a common one in Aristotle.²¹² What is better known *to us* is typically contrasted with what is better known, or more familiar, or first *by nature*. In these contexts the opposition is used for reasoning that proceeds either *from* or *to* first principles. Aristotle argues that we know something, in the fullest sense of the term, when we can demonstrate why it is the case by tracing it back to indemonstrable first principles. These first principles are often described as first, or prior, or more knowable *by nature*, in the sense that premises are prior to the conclusions drawn from them: our knowledge of the conclusions is no “better” or “stronger”

²¹⁰ See also *PA* II.10, 656a10ff, where Aristotle again notes that the shape/form (*morphê*) of the external parts of humans are most familiar to us (*to gnôrimon einai malista*).

Interestingly, Aristotle argues there that the explanatory account of the parts of animals given in *PA* should begin with humans not only because they are most familiar, but also because mankind “partakes of the divine” (*metechei tou theiou*). An indication of this divine nature, Aristotle claims, is that the orientation of the parts of the human body align with the cosmic directions up, down, left, right (i.e. “up” for humans corresponds with “up” for the cosmos, etc.). Thus an aspect of the divine nature of humans corresponds to the shape/form of the human body.

²¹¹ Note, however, that this holds only for the *external* parts of humans. Regarding the *internal* parts, Aristotle claims that these are *least* well known to us. See 494b21ff.

²¹² See e.g. *APo.* I.2, 72a1ff.; *Phys.* I.1; *Metaph.* Z.3, 1029b3ff.; *EN* I.4, 1095b1ff.

than that of the premises, and indeed is in a sense less so. Aristotle often makes the case that those things that are better known *to us* are the conclusions that follow from such first principles, rather than the principles themselves. This is reflected in the methodological passage from *HA* I.6 discussed above, where Aristotle states that “the natural way to conduct an investigation” is to first establish *that* something exists or holds true (in this case, “to grasp the existing differences and attributes” of all animals), and then to search for the causes. Similarly, Aristotle will refer to those things that are “nearer to perception” as being more familiar to us, while the first principles, which are grasped by a sort of induction (*epagogê*) from the particulars provided by perception, are “further from perception” and more familiar *by nature*.²¹³

Is this the same methodological prescription that is raised in passage [3]? Aristotle does argue that the parts of humans are more familiar to us, and that they are clear to perception, however it is not clear that the parts of humans are somehow *first to us* and not *first by nature*, or that the parts of other animals, being less familiar to us, are thereby *more familiar by nature*. Rather, the point of method at issue in [3] focuses on using the knowledge we do have in order to facilitate the acquisition of knowledge we do not.²¹⁴ Just as the money-changer in [3] determines the value of foreign coins based on the local one, so also we will be better able to learn things about the parts of other animals if we study them in terms of or in light of the parts of humans. Many parts of animals are shared by different kinds, but they exhibit differences that may render them less recognizable. Aristotle’s claim in [3] is that by beginning with the parts of humans, we will be better able to recognize and learn about the similar parts in other animals. And in fact this

²¹³ See *APo.* I.2, 72a1ff.; *APr.* II.23, 68b30ff. Aristotle’s infamously difficult account of how we come to know first principles by means of *epagogê* is in *APo.* II.19.

²¹⁴ See e.g. the opening lines of *APo.* I.1: “All teaching and learning of an intellectual kind proceed from pre-existent knowledge” (tr. Barnes 1975).

method of procedure is followed in the *historia*. Not only does Aristotle begin, in *HA* I.7, by discussing the external parts of humans, but he then applies the same basic analysis he develops there of the human body to other kinds of animals later in the *historia*. He recognizes five primary parts of the human body: the head, neck, torso, arms, and legs, and he uses these primary parts to guide his discussion of the human body, beginning with the parts of the head (e.g. skull, face, eyes, ears), and continuing through the others.²¹⁵ These same divisions are then applied, in book II, to four-footed live-bearing animals, four-footed egg-bearing animals, birds, and fish, with relevant differences noted.²¹⁶ Thus by beginning the *historia* with what is best known *to us*, Aristotle is then able more easily to introduce and analyze the parts of other animals, which are less known to us.

Further, one might argue that the aim of the *historia* is not simply to grasp the differences and attributes as they severally appear in different animals, but rather, in the case of the parts, to provide a sense or understanding of what each part is *as the kind of part it is*, that is, in its full generality and universality. In this sense, what is most familiar to us – the parts of humans – are particular instances of these parts understood as universals, and the *historia* will either provide us with a grasp of these universals, or act as a step on the way to the universals. In this sense, the parts of humans will be first to us, while these universal part-concepts will be first *by nature*, and the methodological prescription of beginning with what is first to us and proceeding to what is first by nature will align with the procedure of the *historia*.²¹⁷

²¹⁵ See *HA* I.7, 491a27ff.; *PA* II.10, which follows the same order, and argues that “up” relative to the human body is the same as “up” for the cosmos.

²¹⁶ Four footed live bearing: *HA* II.1, 497b13; four footed egg bearing: II.10, 502b28; birds: II.12, 503b29; fish: II.13, 504b13.

²¹⁷ This is a more controversial claim, and would require a fuller argument to properly support it than is appropriate here. My sense is that, when Aristotle defends beginning the

5.1.1.3 *Ephexês* and *logos*

Aristotle recognizes that someone may criticize his proposed way into the study of the parts of animals as being unnecessarily pedantic, since the parts of humans are sufficiently well known and obvious to us as to require no additional comment. To head-off such criticism, Aristotle offers the following:

[4] So then, by perception the parts [of humans] are not unclear; but just the same, for the sake of not neglecting order and also grasping the *logos* in addition to the perception, the parts must be considered, first the instrumental [parts], and then the uniform [parts]. (*HA* I.6, 491a23-a26)

Τῇ μὲν οὖν αἰσθήσει οὐκ ἄδηλα τὰ μόρια·
ὁμῶς δ' ἔνεκεν τοῦ μὴ παραλιπεῖν τε τὸ ἐφεξῆς καὶ τοῦ
491a25 λόγον ἔχειν μετὰ τῆς αἰσθήσεως, λεκτέον τὰ μέρη πρῶτον
μὲν τὰ ὀργανικά, εἶτα τὰ ὁμοιομερῆ.

While admitting that the parts of the human body are “not unclear to perception,” Aristotle apparently offers two reasons why the investigation should nonetheless begin there: first, in order

historia with the parts of humans because they are most familiar, he is primarily invoking a methodological prescription that enables us to move from one kind of particular instantiation of a universal (e.g. *human legs*) to another (e.g. *four footed live bearing legs*), and not from a particular (*human legs*) to a universal (*legs*). Just the same, I do think that the *historia* is ultimately aimed at providing us with a grasp of this universal, even if it is not actually achieved at this stage of investigation.

not to neglect the proper “order” (*ephexês*), and second, for the sake of grasping the *logos* in addition to the perception, which is already clear. What can we make of these two reasons?²¹⁸

Regarding the first, Aristotle is in effect repeating the claim he made immediately above, that the proper order of investigation dictates that one begin with what is best known or most familiar. The subject matter under consideration is the parts of animals. Since the parts of humans are best known to us, the *historia* should begin there, and should not e.g. move directly to the parts of other blooded animals. But this just raises the question again: why should beginning at the natural beginning be important, if this natural beginning is already well known? That is, why must we rigidly adhere to the proper order of investigation if these beginning facts – those associated with the parts of the human body – are already obvious?

Aristotle’s response is that, although the parts of the human body are clear to perception (*aisthêsis*), we need “to grasp the *logos*” of each of these parts in addition to the perception. That is, perception does not provide the *logos*, and it is this *logos* that is sought and will be provided by the discussion in the *historia*. But *logos* is a rich word for Aristotle, resonating with many different meanings. What does he mean by contrasting *logos* with *aisthêsis* here?

²¹⁸ Peck’s translation of the *kai* in 491a24 as “i.e.” indicates that he takes Aristotle not as providing two distinct reasons, but rather one reason, with the second conjunct elucidating why following the proper order is important. But the Greek construction is *te . . . kai*, which typically indicates two distinct conjuncts (see Smyth 2974). As I go on to argue, I believe Aristotle is offering two reasons why beginning the *historia* with the parts of humans is appropriate. First, since these parts are most familiar to us, they can act as a touchstone to better understanding both the parts of other animals, many of which are similar to the parts of humans, and the parts understood in full generality. And second, though the parts of humans are clear to perception, this clarity of perception does not provide the *logos* of the human parts, which here indicates, as I show below, a detailed written account. Grasping this *logos* is important because, as Aristotle goes on to say in passage [5], it will better position us to identify differences between the parts of humans and those of other animals.

Aristotle uses the opposition between *aisthêsis* and *logos* elsewhere in the context of biological investigation. Typically in these passages *logos* refers to an *explanation* or *causal account* of why a certain state of affairs is the case, or to a *definition* that provides such a cause. For example, at *Juv.* 2, 468a13ff., Aristotle claims that the *archê* of the nutritive soul is located in the middle part of the body, between the part responsible for taking in food and the part responsible for expelling residue. According to Aristotle this is clear both *kata tēn aisthêsin* and *kata ton logon*. The argument from *aisthêsis* relies primarily on evidence derived from severing the bodies of various kinds of animals at different places and observing the results. Specifically, the severed part that includes the middle section appears to live on longer and possess more motion than the other, indicating that the principle of soul is likely located in the middle. The argument from *logos* relies instead on a version of a principle Aristotle often makes reference to in his biological works, namely that nature always does what is best, given what is possible (a variant of the familiar *nature does nothing in vain*).²¹⁹ By placing the *archê* of soul in the middle part of the body, nature ensures that it is close to both the other parts, and this is the best place for it, if it is to control the other parts. Thus *logos* here seems to mean something like “reasoned argument” or “deduction from reasonable principles”²²⁰: given that the *archê* of soul resides in one of the three major divisions of the body,²²¹ and given that nature always does what is best from what is possible, it follows *kata ton logon* that it resides in the middle part.

²¹⁹ See Lennox 1997.

²²⁰ Ogle translates as “rational inference,” while Hett offers “is in itself reasonable.” See also Bolton 2009, who argues that arguments that are *kata ton logon* or *eulogos* are dialectical, and Karbowski 2014, who argues, *pace* Bolton (and in agreement with me), that at least some such arguments “rely upon general facts (*sumbainonta*) about animals established by empirical induction.” See especially his n18.

²²¹ For non-rational animals, each of the “parts” of soul resides in a part of the body. According to Aristotle, only *nous* is unembodied. See *DA* II.1, 413a6ff.; *GA* II.3, 736b21ff..

Similarly, in *GA* I.2 Aristotle argues that the male and the female differ according to *logos*, in so far as they possess different capacities (the male to generate in another, the female to generate within oneself), and also according to *aisthêsis*, in so far as they have different parts. As he discusses in the passage, the capacities have priority over the parts, since the parts are *for the sake of* performing the activities corresponding to the capacities. *Logos* in this passage means something like *definition*: the capacity to generate in another is *what it is to be* male, and the capacity to generate within oneself is *what it is to be* female.²²² The perceptible differences in the parts of the male and the female (i.e. the differences *kata tēn aisthêsin*) are caused by this essential difference in capacity.²²³

In each of these cases the *logos* functions to identify *causes* – the reasons why the facts made clear by perception are indeed the case. In passage [4] above Aristotle argues that the *historia* of the parts of the human body will allow us to “grasp the *logos*” of these parts, but earlier, in the methodological passage in *HA* I.6, Aristotle states that the goal of the *historia* is to grasp the differences between animals *prior* to searching for their causes. Thus it is unlikely that by *logos* Aristotle here intends something like cause, explanation, or definition.^{224 225}

²²² As Bolton 1987 notes, this appears to be only a preliminary account of what it is to be male and female. Aristotle’s analysis of these different capacities ultimately points to a difference in the ability to concoct seed from blood, which the male can do *better* or *more completely* than the female (see *GA* IV.1, 769b9ff.). The difference between them, then, is in a sense a difference in degree, in so far as one has the ability to perform an activity *better* than the other. However, not being able to do something *as well as* something else is one sense of *incapacity* or *inability*. See *Metaph.* Δ.15, 1019a23-26.

²²³ See *GA* III.10, 760b27-33 on the generation of bees, where Aristotle discusses how the *logos*, again understood as reasoned account, must be adapted to cohere properly with the best evidence available by *aisthêsis*. See Karbowski 2014 for a detailed discussion of this very passage.

²²⁴ In *APo.* II.2 Aristotle discusses the sense in which *what* something is (i.e. the definition) is the same as *why* it is, and in II.8 he introduces the notion of a definition that is like a demonstration with the elements rearranged (e.g. thunder is noise in the clouds due to the

Aristotle uses much the same language near the end of his discussion of the external parts of humans in *HA* 1.15, where he considers the orientation of these parts with respect to the cosmic directions up, down, left, and right. He defends the need for that discussion in a similar manner as passage [4], but provides an additional comment on why pursuing such questions, in light of their apparent obviousness, is still important. He states:

[5] But regarding the position of the parts with respect to up, down, front, back, left and right, one might consider this to be clear to perception for the external parts. But nonetheless we must speak of this for the same reason for which we spoke earlier: in order that the order should be followed, and, by reckoning them in this way, it will be less likely that we should overlook those things that do not hold in the same manner in the other animals as in man. (*HA* I.15, 494a20-26)

494a20 Ἡ δὲ θέσις τῶν μερῶν πρὸς τὸ ἄνω καὶ κάτω καὶ πρόσθιον
καὶ ὀπίσθιον καὶ δεξιὸν καὶ ἀριστερὸν ὥς ἔχει, φανερά μὲν

extinction of fire). Thus the definition identifies the causal factor(s) responsible for the properties that belong to a certain kind of thing, and thus explain those properties. The *pre-causal* nature of the *historia* appears to restrict it from being able to say just which properties that belong to a thing are essential and which follow from them. In fact, in *HA* I.6 Aristotle states that the *historia* will provide the material for constructing such a definition (the *peri hōn* and *ex hōn*, or “about which things” and “from which things,” i.e. the conclusions and premises of demonstrations), but appears to stop short of identifying which are which. Thus it appears unlikely that the *historia* will bring to light definitions of this kind, and thus unlikely that by *logos* in passage [4] Aristotle means “definition.” However, such definitions may only be one *kind* of definition recognized by Aristotle. See Bolton 1976, 1978, 1987; Charles 2000, ch. 8, 2010a.

²²⁵ Although the *historia* may not provide the *logos* in this sense, one may read the passage as stating that the ultimate aim (or one of the aims) of the project to which the *historia* belongs is grasping such a *logos*, even if the *historia* is only a preliminary step. On this reading grasping the *logos* is not something achieved in the *historia*.

ἂν εἶναι δόξειε τὰ ἔξωθεν κατὰ τὴν αἴσθησιν, οὐ μὴν ἀλλὰ
 διὰ τὴν αὐτὴν αἰτίαν λεκτέον δι' ἥνπερ καὶ τὰ πρότερον εἰ-
 ρήκαμεν, ἵνα περαίνηται τὸ ἐφεξῆς, καὶ καταριθμουμένων
 a25 ὅπως ἦττον λανθάνη τὰ μὴ τὸν αὐτὸν ἔχοντα τρόπον ἐπὶ τε
 τῶν ἄλλων ζώων καὶ ἐπὶ τῶν ἀνθρώπων.

Here the claim is that although the spatial orientation of the external parts of humans is clear *kata tēn aisthēsin*, it is nonetheless necessary to discuss it “for the same reason we gave earlier.”²²⁶ Again, two reasons are apparently cited: first, following the proper order (*ephexēs*), and second, “by reckoning them in this way” (*katariathmoumenôn hopôs*) we will be less likely to pass over differences between humans and other animals, i.e. similar parts that are differently arranged or structured in humans as compared to other animals. If we take Aristotle here as offering two distinct reasons, as before, and if, as Aristotle indicates, these reasons are the same as the ones given earlier, then the first, following the proper order, is a restatement of the methodological prescription to begin with what is most familiar to us; and the second, that of identifying the differences between humans and other animals “by reckoning them in this way,” is either equivalent to, or related to, the goal of grasping the *logos* of the parts in addition to the perception. That is, “reckoning them *in this way*” refers to the treatment these parts will receive in the *historia*, one that provides us with the *logos*, as opposed to relying on the mere perception of them.²²⁷

²²⁶ Note the singular here of *tēn autēn aitian*, perhaps suggesting that one reason was given earlier.

²²⁷ It may be argued that the *hopôs* in a25 refers to following the proper order, i.e. discussing the spatial orientation of the parts of the human body is necessary because by

5.1.1.4 *Logos* and *akribeia*

But it is still unclear precisely what Aristotle means by *logos* in this passage, or how the *historia* marks an advance over perception. In passages [4] and [5] Aristotle claims that, although some aspects of the parts of the human body are clear to perception, these parts nonetheless warrant discussion in the *historia*. The implication is that the mere perception of these parts fails to provide us with important information that is pertinent to the goals of the *historia*. In passage [4] the perception of the parts fails to provide a grasp of the *logos*, and in passage [5] it seems that relying on perception will make it more likely that we will fail to recognize certain differences between humans and other animals. Thus a grasp of the *logos*, as opposed to relying on *aisthêsis*, will better enable us to identify these differences.

By stressing the importance of discussing even the seemingly obvious parts of humans, Aristotle is emphasizing the level of detail and precision that he is seeking. The notion that the *historia* provides greater precision (*akribeia*) is attested to by many of the references to *historiai* in the other biological treatises – references that most scholars take to refer to *HA*.²²⁸ Such references often appear in the midst of explanations, and are provided to the reader looking for greater detail, typically regarding the characteristics and arrangements of certain parts. From these references we can infer that the *historia* is intended to include meticulous descriptions of

discussing them *first* we will be less likely to pass over differences between humans and other animals. My suggestion, however, is that the *hopôs* refers not to following the proper order, but to discussing the orientation of these parts in the *historia*, rather than relying on our perception of them. Just as in passage [4], following the proper order offers its own benefits, apart from the benefits that the *historia* provides over perception. These benefits are discussed further below.

²²⁸ A TLG search returns 26 different references to *historiai* that likely refer back to *HA*, 3 in *On Respiration*, 1 in *Progression of Animals*, 11 in *Parts of Animals*, and 11 in *Generation of Animals*. Of these, 7 specifically mention the greater degree of *akribeia* that is found in the *historia*. See Appendix A.

the parts of animals, including details that may literally be “overlooked” if we relied only on our perceptions of the parts.²²⁹

Interestingly, many of these references to *historiai* are paired with references to dissections (*anatombai*), which were apparently either drawings of dissected animals, or actual displays of the same.²³⁰ In either case, they were something *looked at* and not rendered into words. In some of these references Aristotle gestures towards the differences of what can be learned from the *anatombai* and *historiai*. For example, in *On Respiration*, in a discussion of the heart and gills in certain fish, Aristotle states:

[6] The position of the heart relative to the gills should be studied visually from the *anatombai*, and in detail from the *historiai*. (*Resp.* 478a34-b2)

ὥς δ' ἡ θέσις ἔχει

τῆς καρδίας πρὸς τὰ βράγχια, πρὸς μὲν τὴν ὄψιν ἐκ τῶν

478b1 ἀνατομῶν δεῖ θεωρεῖν, πρὸς δ' ἀκρίβειαν ἐκ τῶν ἱστοριῶν.

In this passage the *historiai* are said to provide precision or detail (*pros d'akribēian*) regarding the relative positions of the heart and gills, which is distinguished from the visual study (*pros men tēn opsin*) of these parts provided by the *anatombai*. The implication is that *visually* one can gain a certain sense of the arrangement of these parts relative to one another, but

²²⁹ For a possible example of such an error, see the discussion of the parts of the *malakia* in *HA* IV.1, 523b21ff., where Aristotle states that many confuse the head of the *malakia* with the “sac” (*kutos*), which contains the internal organs, because the head is continuous with the feet.

²³⁰ See Lennox 2001a, p. 299.

the precise details require an account in words that specify the manner in which each part is situated. Rendering what is seen in the *anatomai* into words in the *historiai* appears to bring to the study a level of precision and detail that perception alone cannot provide.²³¹

That the *historia* provides a detailed and precise description or account in words, and that this is the sense of the *logos* it provides, is further supported by the following reference from *Parts of Animals*, which again compares what can be learned from the *historiai* to the *anatomai*:

[7] All these, and the other hard-shelled animals, as was said, have a mouth, a tongue like part, a stomach, and a residual outlet, though each part differs in position and size. The manner in which each of them has these parts should be studied with the help of the *historiai* of animals and of the *anatomai*. For some of these things need to be clarified by a *logos*, others rather by visual inspection. (*PA* IV.5, 679b35-680a1, tr. Lennox)

Πάντα μὲν οὖν

679b35 ἔχει, καθάπερ εἴρηται, καὶ τᾶλλα τὰ ὀστρακόδερμα στόμα
τε καὶ τὸ γλωττοειδὲς καὶ τὴν κοιλίαν καὶ τοῦ περιττώματος
τὴν ἔξοδον, διαφέρει δὲ τῇ θέσει καὶ τοῖς μεγέθεσιν. Ὅν δὲ
680a1 τρόπον ἔχει τούτων ἕκαστον, ἔκ τε τῶν ἱστοριῶν τῶν

²³¹ Interestingly, at *HA* III.1, 511a13, Aristotle states the study of the uteruses of different kinds of fish may be done “with greater precision” (*akribesteron*) using “the figures from the dissections” (*tois schêmasin ek tôn anatomôn*). Thus the precision one can gain via *aisthêsis* or *logos* appears to depend on the subject matter at hand.

περὶ τὰ ζῷα θεωρεῖσθω καὶ ἐκ τῶν ἀνατομῶν· τὰ μὲν γὰρ τῷ
λόγῳ τὰ δὲ πρὸς τὴν ὄψιν αὐτῶν σαφηνίζειν δεῖ μᾶλλον.

In this passage the *historiai* are said to provide clarity by means of a *logos*, while the *anatomai* provide clarity by means of visual inspection. The contrast here clearly points to a difference in viewing a picture and reading an account in words,²³² but the clarity that is thereby conferred is not necessarily one that comes via *explanation*. That is, the sense of *logos* used here need not indicate an argument or demonstration. Rather it is the detail provided by words that is sought, either because the reproduction of the drawings is limited, or because Aristotle cannot rely on the acuity of the reader to perceive the detail necessary for the argument.

A final reference secures the claim that the sort of detailed account provided by the *historia* is one in words. In *GA* II.7, in a discussion of the arrangement of umbilical cords in the uterus of animals that produce multiple embryos, Aristotle states:

[8] It is necessary to study these things using the diagrams in the *anatomai* and the writings in the *historiai*. (*GA* II.7, 746a15-16)

746a15 δεῖ δὲ ταῦτα θεωρεῖν ἐκ τε τῶν παραδειγμάτων τῶν ἐν
ταῖς ἀνατομαῖς καὶ τῶν ἐν ταῖς ἱστορίαις γεγραμμένων.

²³² As was noted earlier, *logos* is an especially rich word in Greek generally, and in Aristotle especially, but its root meaning is essentially tied to *speaking* (*legō*) and thus with the sort of rational account that can only be provided in words.

Here Aristotle contrasts the diagrams (*paradeigmata*) in the *anatomai* to the writings (*gegrammena*) in the *historiai*,²³³ the implication being that the former contain pictures, while the latter contain written words.

Based on these references to *historiai* and *anatomai*, we can conclude that when, in passage [4], Aristotle states that, despite their obviousness to perception, the parts of humans must be studied in order to grasp the *logos* in addition to the perception, he is emphasizing the *visual* nature of our perceptual knowledge of the human body, and how an account of the same *in words* is capable of providing a greater level of detail and precision. And it is this greater level of detail, according to passage [5], that will render us less likely to overlook differences between the human body and the bodies of other animals.²³⁴

Aristotle states that the *historia* of animals is primarily a study of the differences exhibited by animals. It begins with a study of their parts, because it is by means of these parts that we first distinguish one kind from another, using the parts to analyze the differences first recognized in animals' whole bodies. Our initially uncritical perception of animals is able to make discriminations between them at a general level, however these first perceptions are poorly differentiated and in need of further analysis. To facilitate this analysis, Aristotle argues that it is fitting to begin the *historia* with the parts of humans, because we will be able to use our familiarity with the human body as a touchstone, as it were, to analyzing the bodies of other

²³³ Interestingly, Peck fails to note this difference, translating the passage as "All this should be studied with the help of the illustrative diagrams given in the *dissections* and *Researches*." It may be that Peck has in mind references to diagrams that apparently appeared in the *HA*. See e.g. *HA* III.1, 510a29-35, which makes reference to a diagram of the male reproductive parts.

²³⁴ Again, this is not to say that a very detailed picture cannot be made, but rather that Aristotle cannot necessarily rely on the "untrained eye" to make note of the details that are important for his exposition.

animals. However, despite this familiarity, he argues that it is nonetheless important to discuss the parts of humans, because by so doing we will advance our knowledge beyond what is provided by the mere perception of our bodies: we will grasp the *logos*. This sort of detailed account in words renders it less likely that we will fail to grasp certain differences between the human body and those of other animals. Rendering what is seen into words provides a sort of precision that is unattainable otherwise, and it is this level of precision at which the *historia* aims.

5.1.2 Organization of the discussion of parts

For the reasons discussed above, Aristotle begins the discussion of the parts of animals with those of humans. The aims of this discussion are: (1) to document the features exhibited by these parts in order that differences between the parts of humans and the parts of other animals may more easily be identified; and (2) to develop the primary part-concepts used to analyze other animals. The discussion is divided by parts that are external (I.7-15) and those that are internal (I.16-17).

5.1.2.1 The external parts of humans: *HA*: I.7-15

The discussion of the external parts of humans is organized around the following initial division of the human body: head (*kephalê*), neck (*auchên*), trunk (*thorax*), arms (*brachiones*), and legs (*skelê*). The discussion proceeds as follows:

- Parts of the head: ch. 7-11
- Parts of the neck: ch. 12 (to 493a10)

- Parts of the trunk: ch 12-15 (to 493b25)
- Parts of the arms: ch 15 (493b25-494a4)
- Parts of the legs: ch 15 (494a4-19)
- Arrangmenet of these parts with respect to up/down, back/front, left/right (ch. 15, 494a19-b18).

Consistent with the goal of using our familiarity with the parts of humans as a guide to understanding the parts of other animals, the discussion in this section sometimes makes reference to the corresponding parts of other animals, typically for the purpose of identifying differences between them. For example:

- The part below the skull is called the face in humans, but not in other animals (491b10).
- Like humans, all other animals have eyes except for the *ostrakoderma* and any other imperfect (*ateles*) animal; in particular all live-bearing animals have eyes, and even the mole has something like an eye beneath a flap of skin (491b26).
- The white of the eye is very much the same in all animals, but the black shows many differences (492a1).
- Humans are the only animal that possesses ears but cannot move them; not all animals that have hearing have ears, some merely have passages; all live-bearing animals have ears apart form the seal, dolphin, and other cetaceans (492a23).
- All animals with jaws move the lower jaw except the river crocodile, which moves the upper jaw instead (492b24).

These additional details bring to light features that (a) are not universally associated with the part in question, and thus are not essential features of that part, and (b) are uniquely associated only with certain kinds of animals, and thus must be explained by making reference to some other unique feature of those animals. For example, all live-bearing animals have eyes, but since the black differs among them, we cannot take the black of the human eye as a feature that belongs to the eye in itself, while the white of the human eye, being basically the same as the white in other animals' eyes, may be taken as a feature belonging to the eye in itself. Similarly not all animals that can hear have ears, and thus the presence (or absence) of ears must be explained by something other than the mere capacity for hearing. And finally, being able to open and close the jaw is a feature shared by all animals with jaws, but which part of the jaw moves differs. What is necessary is that some part moves, and the explanation for whichever part moves in a given animal will be specific to the kind (or kinds) that have jaws that move in that way. Although the focus in this section is clearly on the human parts, the ultimate goal of identifying the differences between humans and other animals is clearly represented.²³⁵

5.1.2.2 The internal parts of humans: *HA*: I.16-17

Following the discussion of the external parts of humans, Aristotle turns to the internal parts of humans. However, unlike the discussion of the external parts, the internal parts of humans are mostly unknown to us:

²³⁵ Interestingly, for reasons that are not clear to me, references to animals other than humans appear almost exclusively in the discussion of the parts of the head.

[9] So then, the visibly external parts are arranged in this manner, and just as was said, for the most part are named and well-known due to their familiarity; but it is the opposite for the internal parts. For the parts of human beings are mostly unknown, so that it is necessary to study the parts of other animals, which have a similar nature.

494b19 Τὰ μὲν οὖν μόρια τὰ πρὸς τὴν ἔξω ἐπιφάνειαν τοῦτον
τέτακται τὸν τρόπον, καὶ καθάπερ ἐλέχθη, διωνόμασταί τε
μάλιστα καὶ γνώριμα διὰ τὴν συνήθειάν ἐστιν· τὰ δ' ἐντὸς τοῦ-
ναντίον. Ἄγνωστα γάρ ἐστι μάλιστα τὰ τῶν ἀνθρώπων, ὥστε
δεῖ πρὸς τὰ τῶν ἄλλων μόρια ζώων ἀνάγοντας σκοπεῖν, οἷς
ἔχει παραπλησίαν τὴν φύσιν.

Aristotle does not state why the internal parts of humans are mostly unknown (presumably due to taboos against human dissection), and he gives no details regarding the criteria that will be used to judge which animals are similar enough to humans to stand in for the study of internal parts. The animals most often cited in the actual discussion (dog, pig, ox) are all among the four-footed live-bearing, which Aristotle consistently ranks, with humans, as the more perfect and complete animals.²³⁶

The question arises: if the study of external parts began with humans because of our great familiarity with them, then why should the study of internal parts also begin with humans, if these are least well known to us? It's clear that the benefits discussed above relating to beginning

²³⁶ E.g. *GA* II.1, 732b28ff.

with what is most familiar will not be conferred upon the study of internal parts, if we begin with humans. Why nonetheless start here?

On the one hand, it may be that, since humans were discussed first for the external parts, so, for the sake of consistency, they are discussed first here as well. Although Aristotle does not evince great concern with organizing his discussions of the parts of animals (or any of their differentia for that matter) around individual kinds (or forms) of animals, grouping the discussion of the parts of humans, both external and internal, in one place may seem like a good idea, given the understandable interest in these parts. On the other hand, it may be that, since humans are the most complete animals, their internal parts too reflect this completion and perfection, and thus serve as exemplary instances of the parts in question. Little good this will do if the human parts are mostly unknown. However, if Aristotle can plausibly/reasonably turn to certain other animals as a proxy for humans, then beginning here may still make sense. As mentioned above, Aristotle offers no argument or insight regarding the criteria he uses to judge which animals have a “similar nature” (*paraplêsian tēn phusin*) to humans, but if he believed that he had hit upon such similarly-natured animals, such that the study of their parts, together with the little knowledge available of the human parts, provided an accurate picture of the internal parts of humans, then treating humans first would still make sense. That is, beginning with humans may still reflect the proper order of procedure, as was stressed above with the external parts. The parts of humans, both external and internal, would then provide the model or framework within which the parts of other animals are considered.²³⁷

²³⁷ The discussion of the internal parts follows the “top down” approach (relative to humans) used for the external parts.

The discussion of the internal parts follows the same basic divisions of the body used for the external parts:

- Internal parts of the head (brain, passages from eyes to brain): ch. 16 (494b25-495a18)
- Internal parts of the neck (esophagus, Windpipe, Epiglottis): ch. 16 (495a18-b24)
- Internal parts of the torso (Lung, Stomach, Gut, Omentum, Mesentery, Heart, Diaphragm, Liver, Spleen, Gallbladder, Kidney, Bladder): ch 16-17 (495b24-497b2)

The discussions of these parts tend to focus on their size, character, and arrangement, but little or no mention is made of the *functions* played by these parts. At times there are comments that imply their functions, but the clear focus is on describing the shape and placement of the parts, and their mutual interconnections and relations.

Similar to the discussion of the external parts, reference is sometimes made to similarities and differences between the human parts and those of other animals. For example:

- All blooded animals have a brain, as do the *malakia*; man's brain is largest and most fluid (494b26).
- Differences in the lung; its tendency to be double (*dimerês*); least visible in humans, most visible in egg-bearing animals (495b1).
- Man's stomach resembles the dog's; the lower stomach is like the pig's (495b25).

- Man's liver resembles the ox's (496b24).
- Man's kidney resembles the ox's (497a1).

Unlike the discussion of the external parts, many of these references to other animals appear to be for the sake of identifying animals with similar natures, and thus similar internal parts that can be studied in place of those of humans, rather than identifying differences between humans and other animals.

In fact, one often gets the sense that the discussions of these parts are focused more on the part in question, rather than on the way in which that part appears in humans. For example, in his discussion of the brain, the only detail Aristotle provides that is unique to humans is that, relative to their size, humans have the largest and most fluid brains (494b29). All of his other comments are applicable either to all animals with brains, or important large subsets of them (e.g. the blooded animals). On the one hand, this may simply reflect Aristotle's ignorance of the internal anatomy of humans, but on the other hand (or additionally) it may reflect Aristotle's interest in grasping the primary, common features exhibited by the part in question, in order to come to an understanding of the part *qua* specific part, so that unique differentiations of the part as it appears in different kinds of animals may more easily be noticed.

5.1.2.3 External parts of blooded animals

Following the discussion of the parts of humans, Aristotle considers the parts of other animals, beginning with the blooded animals. The discussion in these chapters is at times hard to

follow (especially in II.1)²³⁸, and it is difficult to discern the principles that are organizing the material. However, they become more apparent if we attend to the various introductory and concluding statements Aristotle makes as new subjects are introduced.

For example, II.1 begins with a reiteration of the forms of sameness and difference first discussed early in book I, then turns to what appears to be a discussion of the ways these forms of sameness and difference manifest themselves among four-footed live-bearing animals, however the discussion wanders into differences exhibited by egg-bearing animals, birds, and seals. At 502b27, about five Bekker pages into book II, we find the following statement:

[10] The parts of the live-bearing animals that are external hold in this manner
(502b27)

Τὰ μὲν οὖν τῶν εἰς τὸ ἐκτὸς ζῳοτοκούντων μέρη τοῦτον
ἔχει τὸν τρόπον.

Thus it appears that the preceding discussion was intended to treat the external parts of the live-bearing animals. All live-bearing animals, or only some subset? Passage [10] does not specify, but the initial statement that introduced the section (immediately following the reiteration of the forms of sameness and difference, at 497b14) specified *four-footed* live-bearing animals.

The next section is introduced with the following:

²³⁸ Indeed the chapter divisions in the early portions of book II are especially confused (and, notably, post-Aristotelian), and the reader often does well to pay them little mind.

[11] But the four-footed, egg-bearing, blooded animals (and no land animal is egg-bearing and blooded unless it is four-footed or footless) have a head, neck . . .
(502b28)

502b28 Τὰ δὲ τετράποδα μὲν ὀτοκόκα δὲ καὶ ἔναι-
μα (οὐδὲν δὲ ὀτοκεῖ χερσαῖον καὶ ἔναιμον μὴ τετράπουν ὄν
b30 ἢ ἄπουν) κεφαλὴν μὲν ἔχει καὶ αὐχένα

The inclusion of *four-footed* with *egg-bearing* (and *blooded*) here suggests that the absence of *four-footed* from the concluding statement of the previous section is either for the sake of brevity or an over-sight. But what of the comment here on the footedness of egg-bearing land animals? The fact that egg-bearing land animals are either four-footed or footless is a relevant addition only if the discussion is intended to treat *land animals*. That is, turning to *four-footed* egg-bearing animals might cause a reader pause if the expectation was to proceed from *live-bearing* land animals to *egg-bearing* land animals. Why restrict the discussion, a reader might ask, to the *four-footed* egg-bearing land animals? Aristotle's response: "All egg-bearing land animals are either four-footed or footless; we shall treat the four-footed ones first, and turn to the footless later."

Thus it appears that the primary organizing principles of these early sections of book II are, first, external vs. internal parts; second, for the external parts, land animal vs. water animal; and third, for the external parts of land animals, live-bearing versus egg-bearing. This suggestion is confirmed by examining how the discussion proceeds from here. Having treated egg-bearing

land animals (the river crocodile²³⁹ and the chameleon are the only ones mentioned), Aristotle turns to birds (another egg-bearing land animal), then fish. He introduces the discussion of fish as follows:

[12] Among the water animals, the kind of fishes is one, distinct from others, embracing many forms. Fishes have a head . . . (504b13-15)

Τῶν δ' ἐνύδρων ζώων τὸ τῶν ἰχθύων γένος ἐν ἀπὸ τῶν
ἄλλων ἀφώρισται, πολλὰς περιέχον ἰδέας. Κεφαλὴν μὲν
γὰρ ἔχει . . .

This appears to mark a transition from *land animal* to *water animal*. The last kind of animal discussed in the section on external parts, immediately following the discussion of fishes, is snakes, regarding which Aristotle states:

[13] It remains to speak, among the blooded animals, of the kind of snakes. And they are common to both, for the majority of them are land animals, while a few, those of the water animals, spend their time in fresh water. (505b5-7)

Λοιπὸν δὲ τῶν ἐναίμων ζώων τὸ τῶν ὄφεων γένος. Ἔστι
δὲ κοινὸν ἀμφοῖν· τὸ μὲν γὰρ πλεῖστον αὐτῶν χερσαῖόν ἐστιν,

²³⁹ One might object that the river crocodile is a *water animal*, in the sense that it lives and spends most of its time in the water. Fair enough, but I suggest that the sense of *land animal* / *water animal* at work here focuses on *taking in air* and *taking in water*.

ὀλίγον δὲ τὸ τῶν ἐνύδρων ἐν τοῖς ποτίμοις ὕδασι διατελεῖ.

The snakes are discussed last because they are not easily classified as land or water animals: certain forms are land animals, others water. Thus it seems that the major division of the larger discussion of the external parts of blooded animals (other than humans) is between land and water animals. That Aristotle should use this difference as the primary means of organizing his discussion is consistent with the emphasis he placed on the difference in the introductory *tupos* of book I. I stated earlier that it is likely that Aristotle considered the difference land animal/water animal as one of *bios*. That this difference in *bios* is used to organize the discussion of the parts of these blooded animals suggests that the parts of animals will show similarity based on which side of this *bios* division they fall: land animals will show greater similarity of parts as compared to water animals. And this, in turn, suggests that *bios* has explanatory priority over the parts. And this is just what we should expect given the discussion of explanation and demonstration in *PA* I.

5.1.2.4 Example: external parts of birds

In order to get a better sense of Aristotle's actual method of procedure in the *HA*, in this section I provide a brief analysis of a single part of the discussion of the external parts of blooded animals—those of birds. The discussion of the external parts of birds is as remarkable for what is *not* said as for what is. The entire discussion barely takes up a Bekker page (503b29-504b14), but its brevity is accounted for by Aristotle's focus on noting the similarities between birds and the animals already discussed (i.e. humans, four footed live bearing, and four footed egg bearing), and on describing those parts that are peculiar or unique (*idion*) to birds.

The discussion begins by noting the broad similarities and differences between a bird's body and the bodies of the animals already discussed (four-footed, live-bearers/egg-bearers), using the schematic model of the body developed from humans. It is specified that all birds have a head, neck, back, underside, and the analogue of a chest (503b30), but nothing further is said about this, presumably because the differences between e.g. a bird's head and a human's, in so far as they are heads, are not very remarkable. That birds have two legs is called out, because it is remarkable that birds and humans have this similarity, which most other animals lack. Thus the lack of detail with regard to these parts is due to the fact that they do not exhibit any great differences that require additional explanation.

The following parts are specifically highlighted as differing in, or being unique to, birds compared to other animals:

- Wings instead of forefeet or hands
- Unusually long haunch-bone
- Beak for a mouth
- Feathers instead of horny-scales or hair
- Ability to utter articulate sounds
- The appearance of spurs and crests in some forms

All of these attributes are unique to birds compared to other animals, and thus an explanation of these features (if there is one)²⁴⁰ must proceed from the nature of *birds* rather than

²⁴⁰ It is possible that some such features are inexplicable, in so far as they may be essential, un-mediated features of birds. For example, the possession of a beak is common to all birds

any higher level of organization or classification. Although the *HA* stops short of identifying features as being essential to a given kind (and therefore falls short of explicitly identifying the possible causal relationships between features), it regularly uses the language of “common” (*koina*) and “unique/peculiar” (*idion*).²⁴¹ By identifying features as common to larger groups and unique to smaller ones, the *HA* enables one to formulate the sort of “follows/followed by” extensional relationships between features emphasized in *APo.* II, and thus to aim further research into possible causes. This explains the great *lack* of detail regarding many of the features of birds, and the *abundance* of detail for other parts.

5.1.3 Reflection on the discussion of parts in *HA*

I have argued above that the *historia* of the parts of animals aims at providing the reader with both a grasp of the various parts found among many animals, understood at a level of generality that is common to these many animals, and a grasp of the differences in these parts as they actually appear in the various animals that possess them. There is a marked interest in establishing the level of generality at which a part is common to many animals, and unique to few.²⁴² The organizing principles employed in these sections are primarily the important differentiae blooded/bloodless, land/water, and live-bearing/egg-bearing. The use of the *megista genê* as organizing principles is subordinate to these (e.g. the division between birds and fish follows from the division of land and water animals), and I suggest that this is because Aristotle recognized many extensional correlations of features with these differences, and, I suspect,

and is perhaps not further explicable, though the shape, length, hardness, etc. of the beak possessed by a particular form of bird may have an explanation.

²⁴¹ See Lennox 1990, p. 178 for additional examples.

²⁴² See Lennox 1987a, 1991; Gotthelf 1988.

believed that these organizing differentiae had causal relevance in the explanation of the various correlated features. There is not great concern evinced in these discussions with identifying the precise forms of animals that exhibit the various differences he lists, below the level of “birds,” “fish,” etc. Rather Balme’s comment that the animals are “brought in as witnesses” to the differentiae seems closer to what we actually find in the discussions.

5.2 HA V-VI, IX: ON GENERATION AND REPRODUCTIVE ACTIVITIES

Books V, VI, and IX²⁴³ of *HA* treat the generation and reproductive activities of animals, broadly speaking. Book IX is focused on humans (but appears to only begin to address the topic), and books V-VI treat the other animals. The discussions in these books are wide-ranging and more difficult to characterize relative to the picture of a *historia* I have attempted to develop in the preceding chapters.

²⁴³ All the MSS of *HA* have the book dedicated to reproduction in humans ordered last (i.e. IX), as do all the translations of *HA* prior to the Latin edition of Theodorus of Gaza (c. 1398 – c. 1475), who re-ordered the treatise, placing the book on human reproduction immediately following books V and VI on reproduction in other animals. This new ordering was retained by all future editions of *HA* (most notably Bekkers), until Balme restored the MS ordering in his 1991 Loeb edition, and the *editio maior* that followed in 2002. I follow Balme’s ordering. See Balme 1991, pp. 18-9, 2002, pp. 1-2; Beullens and Gotthelf 2007; Gotthelf 2012a, pp. 289-92

5.2.1 Summary of Contents

The following provides a brief summary of the contents of books V, VI, and IX:²⁴⁴

HA V.1: introduction and modes of reproduction

The opening lines of book V state that the discussion will be “about generation” (*peri tôn geneseôn*), and announce the order in which the discussion will proceed. Animal generation will be discussed according to the *megista genê*, but in the opposite order as the discussion of parts, treating humans last instead of first. V.1 continues with a review of the different modes of reproduction, from sexual to spontaneous. The discussion is similar to that found in *GA* I.1, where Aristotle is concerned with establishing sexual generation as the norm.²⁴⁵ Here, however, the emphasis seems to be on *differences* in modes of reproduction, with extended comments on the spontaneously generated animals that nonetheless have males and females that copulate, and the unique cases of seemingly hermaphroditic fish.

HA V.2-14: differences in copulation, breeding seasons, and sexual maturity

The official discussion of reproduction in the various *megista genê* is postponed, and beginning with V.2 there follows a discussion of the different modes of animal copulation, breeding seasons, and ages of sexual maturity. These discussions generally proceed by *megiston genos*, but treat humans and the “higher” kinds first (i.e. proceed in reverse order to that announced in V.1).

²⁴⁴ Note that the discussion of the uniform and non-uniform reproductive parts (e.g. testicles, penis, uterus, seed) appear in book III (non-uniform in III.1, uniform in III.20-22). Additionally, IV.11 discusses various differences between the male and the female.

²⁴⁵ See Balme 1992, p. 127.

HA V.15-32: reproductive practices – bloodless animals

Beginning with V.15 Aristotle enters into the proper discussions of reproduction in the various animal kinds, following (for the most part) the order which he laid out in V.1. The spontaneously generated *ostrakodema*, sea anemones, and sponges are treated first (15-16), then the *malakostraka* (17) and *malakia* (18). Following this is a long discussion of the insects (19-33), with special emphasis given to bees and wasps (20-24).

HA V.33-VI: reproductive practices – blooded animals

The discussion of reproduction in blooded animals extends from the end of book V through book VI. Book V ends with a discussion of the egg-bearing four-footed animals, including turtles, lizards, and crocodiles (V.33), and the snakes and vipers (V.34). These chapters focus on the animals' breeding seasons, the number and character of the eggs they lay, and their incubation habits. Book VI opens with a discussion of birds (VI.1-9). The focus is on birds' breeding seasons, the number of eggs they lay, and their nesting and incubation habits (1); a detailed discussion of the similarities and differences between birds' eggs (2); the development of the bird embryo within the egg (3); and then proceeds to a discussion of different forms (i.e. "species") of birds, including pigeons, vultures, eagles, cuckoos, and peafowl, focusing again on their breeding seasons, the number of eggs they lay, and their nesting and incubation habits (4-9). From birds the discussion next turns to water-dwelling animals, especially fish (VI.10-17). It begins with the live-bearing fish (i.e. the selachia) (10-11) and cetacean (12), then moves to the egg-bearing fish (13-14), spontaneously generated fish (15), and eels (16). The discussion of fish ends with an extended discussion of the differences in breeding seasons (17). Book VI ends with

a discussion of the blooded, live-bearing footed animals (VI.18-37). The discussion begins with general remarks on the pleasure and excitement associated with copulation that is shared by all these animals, and the fierce and sometimes unusual behavior that results (18). Next, following a discussion of menstruation in these animals (18), then individual “forms” or “species” are treated, including pigs (18), sheep and goats (19), dogs (20), cattle (21), horses (22), asses (23), mules (24), camels (26), elephants (27), wild boars (28), deer (29), bears (30), lions (31), hyenas (32), rabbits (33), foxes (34), wolves (35), cats (35), half-asses (36), and mice (37). The treatment of the domesticated animals – such as pigs, cattle, and horses – tends to be much longer and more detailed than the wild animals. The discussions are quite varied, but often focus on breeding and copulation habits, age of sexual maturity, the number of offspring generated, the duration of pregnancy, and the rearing of the young.

HA IX: reproductive practices: humans

Book IX announces its subject matter with the following: “regarding the generation of humans . . . as many things as happen due to their proper nature, are in this manner” (*peri d’ anthrôpou geneseôs . . . osa sumbainei dia tèn phusiv tèn oikeian, tond’ echei ton tropon*) (581a9-11). The discussion begins with the signs of sexual maturity in men and women and the changes their bodies undergo (1), then moves to menstruation in women (2). Next the signs of successful conception in women are discussed, as well as the early development of the fetus (3). Further changes in women during pregnancy are addressed next, as well as varying durations of pregnancy (4). A consideration of the typical ages of sexual maturity and decline appears next, including a discussion of reproductive problems among men and women (5-6). The development

of the embryo is next examined (7-8), then labor and childbirth (9-10) and changes in women after giving birth (11). Finally, the condition of new-born babies is briefly discussed (12).

5.2.2 HA V.1: introduction to the discussion of generation

Aristotle begins the discussion of generation with the following comment regarding the order according to which the discussion should proceed:

[14] It remains to discuss the generation of animals, beginning with those things that are primary. These are many and diverse, some dissimilar, and others in some manner similar to one another. And since the kinds have been divided earlier, in the same way also now we must attempt to make our investigation, Only before we made our beginning of the study of parts with man, but now we must speak of this last because it involves much work. We must begin first with the *ostrakoderma*, and after these the *malakostraka*, and the others in this way in order.

539a1 περὶ δὲ τῶν γενέσεων αὐτῶν λοι-
πὸν διελθεῖν, καὶ πρῶτον περὶ τῶν πρώτων. Εἰσὶ δὲ πολλαὶ καὶ
πολλήν ἔχουσαι ποικιλίαν, καὶ τῇ μὲν ἀνόμοιοι, τῇ δὲ τρό-
πον τινὰ προσεοίκασιν ἀλλήλαις. ἐπεὶ δὲ διήρηται τὰ γένη
a5 πρότερον, τὸν αὐτὸν τρόπον καὶ νῦν πειρατέον ποιεῖσθαι τὴν
θεωρίαν· πλὴν τότε μὲν τὴν ἀρχὴν ἐποιούμεθα σκοποῦντες
περὶ τῶν μερῶν ἀπ' ἀνθρώπου, νῦν δὲ περὶ τοῦτου τελευταῖον

λεκτέον διὰ τὸ πλείστην ἔχειν πραγματείαν. πρῶτον δ' ἀρ-
κτέον ἀπὸ τῶν ὀστρακοδέρμων, μετὰ δὲ ταῦτα περὶ τῶν
a10 μαλακοστράκων, καὶ τὰ ἄλλα δὴ τοῦτον τὸν τρόπον ἐφεξῆς.

Aristotle then lists the order of the kinds to be treated, but the actual discussion in *HA* doesn't follow this order perfectly:

<u>Announced in <i>HA</i> V.1</u>	<u>Actual order in <i>HA</i></u>
<i>ostrakoderma</i>	<i>ostrakoderma</i>
<i>malakostraka</i>	<i>malakostraka</i>
<i>malakia</i>	<i>malakia</i>
insects	insects
fishes (live-bearing/egg-bearing)	footed egg-bearing animals, and snakes
birds	birds
footed egg-bearing animals	live-bearing fishes and cetacea, egg-bearing fishes
footed live-bearing animals	footed live-bearing animals
humans	humans

Birds (VI.1-9) are actually treated before fishes (VI.10-17); the egg-bearing four-footed animals are discussed in V.33, not with the live-bearing four-footed animals, but just after the

insects and before the birds. (I think the principle behind the actual ordering is egg-bearing: walking, flying, swimming). Snakes and vipers are discussed with the egg-bearing four-footed animals.

Why should the *historia* of generation proceed in the opposite order compared to that of the parts of animals? The reason Aristotle provides is that it “involves the most work” (*dia to pleistên echein pragmateian*), but what does this mean? In what sense is the generation of humans more complicated, or its study involve more work, than the other animals? If anything, one might suspect that the study of generation in humans would be *easier*, due to the (forgive the pun) intimate knowledge we have of its methods and procedures. Alternatively, if the reference is to the actual development of the human fetus, from embryo to newborn, then such a project may involve the most work for Aristotle, given the relative paucity of information he must have had at his disposal regarding these stages of development, given the restrictions on human dissection and, presumably, research.

We may approach an answer to this question by first rendering more precise what Aristotle means when he says the subject matter of these books is *genesis*. A review of the contents of these books from the previous section suggests that their focus is less on the physiological processes that take place in generation (i.e. the manner in which the male and female seeds interact and change in order to bring about an offspring one in form with the parents—arguably the focus of *GA*),²⁴⁶ and more on the different manners in which animals achieve the goal of reproduction, i.e. the different ways in which they copulate, their breeding seasons and ages of sexual maturity, the number of offspring they have and how they go about

²⁴⁶ If I am correct in differently characterizing the primary subject matters discussed in *GA* and these books of *HA*, then it brings into question whether the relation between these books of *HA* and *GA* is one of *hoti* to *dioti*.

caring for them, if at all, etc. in fact, much of what is discussed in these books of *HA* may be best characterized as *reproductive activities*.

Understood in this way, we may now ask whether reporting the details of the reproductive activities of humans requires “more work” than those of other animals. There is reason to think that Aristotle believed that it did. As will be discussed further below,²⁴⁷ Aristotle held that the greater the cognitive capacities of an animal kind are, the more complicated their activities and manners of life become. Thus while the actual physiological process of generation may be equally complicated in the so-called “lower” forms of animals as the higher, the activities surrounding the conception, birth, and rearing of the offspring of the higher kinds (with humans understood as the highest) will be more varied and complicated, and thus require “more work.”²⁴⁸

5.3 ON MANNERS OF LIFE, ACTIVITIES, AND CHARACTERS

In many ways, the subject matter discussed in book VII is quite different from book VIII, however their joint presentation may be defended by the introductions that begin each book, which share many of the same themes. In fact, it may very well be that the first chapter of book

²⁴⁷ See *HA* VII.1, 589a1ff., and below, section 4.2.

²⁴⁸ It’s interesting that the contents of book IX on human generation, focused as it is on many *physiological* aspects of pregnancy and reproduction, do not support this conclusion as well as I’d like. One possible reason is that the discussion we have in book IX represents only the beginning of a discussion of human generation. As it stands, the *HA* lacks an exhaustive treatment of many aspects of the activities and lives of humans. It may be argued that at least some of these topics are covered in other treatises, such as *NE* and *Pol*.

VII serves as an introduction to *both* books, with the introduction to book VIII reiterating some of the main points made in VII, while adding a few of its own.

In what follows I provide brief summaries of the contents of books VII and VIII (section 4.1), and I then turn to the introductory passages of both books (section 4.2), in which Aristotle establishes the *bios*, *praxis*, and *êthos* as legitimate subjects of scientific investigation. I then turn to an analysis of select passage in these books (section 4.3), which is followed by a concluding reflection on books VII and VIII (section 4.4).

5.3.1 Brief summaries of *HA* VII and VIII

Book VII may be divided into the following five sections:

1. *Philosophical introduction (VII.1, 588a16-589a10)*

The first chapter of book VII consists in an extended philosophical reflection on (1) the presence in other animals of certain differentiae (especially those related to *êthos*) commonly associated only with humans, and (2) the near continuous gradation of variation in animal differentiae across the different kinds of animals. The whole introduction seems to serve as a defense of the study of differentia relating to *bios*, *praxis*, and, especially, *êthos*, in animals other than humans.

2. *Water vs. land animal (VII.2, 589a10-b18)*

The introduction to book VII ends by noting the relationship between an animal's material constitution and the food the animal typically eats. This leads to a consideration of the environments in which animals characteristically live. The basic division *water animal/land*

animal is introduced here again, as it was in the *tupos* of book I, and similar divisions are again discussed. Greater emphasis is now placed on the importance that bodily blend (*krasis*) plays in determining whether an animal is a land or water animal. Indeed, bodily blend appears to be the *primary* consideration, while that of *taking in and expelling water or air* is a sufficient, but not necessary, condition.

3. *Feeding and nutrition* (VII.2-11, 589b18-596b20)

The recognition of the close relationship between the environment in which an animal lives, the material blend of its body, and the food it eats leads naturally to a discussion of feeding and nutrition (*trophê*). Three primary differentia are introduced: flesh-eater, plant-eater, and all-eater, and they are applied to animals according to *megista genê*.

4. *Migration, hiding, and the shedding of skin* (VII.12-17, 596b20-601a23)

The discussion turns next from nutrition and feeding to the different manners by which animals protect themselves from excessive heat or cold in their environments. The topics are related in so far as they are in part determined by the environment in which an animal lives. The topics discussed in this section include migration, hiding (hibernation/aestivation), and the shedding of skin.

5. *Conditions in which animals thrive* (VII.18-30, 601a23-608a7)

In this final long section Aristotle discusses a number of conditions that affect the good health and general “thriving” of different animals. These include the seasons during which animals most thrive and the diseases that most commonly affect them (VII.18-27, 601a23-

605b21); the places where animals thrive most and generally how animals in different places differ (VII.28-29, 605b21-607a34); and how pregnancy affects animals' conditions (VII.30, 607b1-608a7)

The thematic connection between these disparate sections appears to be as follows: the primary elemental environment in which an animal lives and spends most of its time in part determines the material make up of the animal's body, and thus also the food it is required to eat in order to survive. Thus there is a natural connection between the environment in which an animal lives and its nutrition. An animal's environment also changes seasonally, and thus animals must protect themselves from seasonal excesses of heat and cold in order to survive and thrive, and different animals do so in different manners. Indeed, the factors that affect an animal's thriving and good condition are varied. As Balme states: "the whole (of book VII is held together by the theme of natural constitutional health . . ." ²⁴⁹

Book VIII may be divided into the following six sections:

1. Philosophical Introduction (608a11-21)

Similar to book VII, book VIII begins with a short reflection of the study of *êthos* in animals other than humans. Its purpose is to establish that animals exhibit traits of character, though to a lesser extent than humans.

2. Differences in character between males and females (608a21-b18)

²⁴⁹ Balme 1991, p. 57, note b.

The discussion of character begins by noting differences of character that generally apply to males and females, regardless of animal kind.

3. Friendship and Enmity among animals (608b19-610b19)

A long discussion of friendships (*philiai*) and enmities, or “wars” (*polemoi*), among animals follows. The cause is identified as living in the same place and feeding on the same things (or, indeed, on one another).

4. Intelligence and stupidity in animals (610b20-629b5)

This section focuses on the various ways in which animals seem to act intelligently in order to help themselves. The discussion begins with four-footed animals (chs. 3-6), and proceeds to a long treatment of birds (chs. 7-36), water animals (fish, *malakia*, etc.; ch. 37) and insects (38-43), especially bees.

5. Gentleness and wildness in animals (629b5-631b4)

In this section Aristotle returns to a topic touched upon in the section on friendship and enmity, namely the traits of gentleness (*praotêta*) and wildness (*agriotêta*). The discussion is abbreviated and not very focused, beginning with a treatment of certain land animals (lion, “thos,” bison, elephant, camel), and turning then to water animals, but discusses only the dolphin.

6. Other activities that affect character (631b5-633b8)

Book VIII ends with a brief discussion of the manner in which changes in an animal's *pathê* (which Balme translates as “occasional bodily states”) may affect their character, as also their activities. The actual topics discussed include changes in the bodily form and character of animals due to castration (631b19-632a34), the effects of rumination (632a35-b14), and seasonal changes to birds (632b15-633b8).

5.3.2 Philosophical introductions: *HA* VII.1 and VIII.1

Both books VII and VIII begin with philosophical reflections on the relationship between the cognitive capacities exhibited by animals, and those exhibited by humans. The similarities of these introductions suggest that the two books form something of a pair, though the subjects discussed in them are ultimately quite different.

5.3.2.1 Introduction to *HA* VII

VII.1 begins with a transitional statement,²⁵⁰ marking the end of the discussion of generation in books V and VI,²⁵¹ and the beginning of a new subject matter in VII:

²⁵⁰ In some manuscripts, this sentence appears at the end of book VI instead. This variation in ending and beginning sentences between books is common in the manuscripts.

²⁵¹ But what of Book IX, which treats, to some degree, of generation in humans? The best account of the ordering of these books holds that book IX *begins* the discussion of *bios*, *praxeis*, and *êthê* in humans, but only gets it off the ground. See Gotthelf 2012a, pp. 289-92.

[15] Such then is the nature of the animals in other respects, and also in their generation. Their activities and ways of life differ according to their characters and nutrition. (588a16-18)

588a16 Τὰ μὲν οὖν περὶ τὴν ἄλλην φύσιν τῶν ζώων καὶ τὴν
γένεσιν τοῦτον ἔχει τὸν τρόπον· αἱ δὲ πράξεις καὶ οἱ βίοι
κατὰ τὰ ἦθη καὶ τὰς τροφὰς διαφέρουσιν.

Aristotle here asserts that the activities and manners of life of animals differ “according to” their characters and nutrition. The *kata* in a18 is ambiguous regarding the exact relationship between *praxis* and *bios*, on the one hand, and *êthos* and *trophê* on the other. As one set varies, so also, apparently, does the other, but whether they are *causally* related, such that e.g. differences in *bioi* cause differences in *êthê*, or *vice versa*, is underdetermined.²⁵² The ensuing discussions in books VII and VIII do treat both *êthos* and *trophê* (*êthos* in VIII, *trophê*, among other things, in VII), so the connection is drawn here in order to introduce these topics by way of their relationship with the established forms of difference discussed earlier, *bios* and *praxis*.²⁵³ The inclusion of *êthos* here, and the defense of the study of *êthos* in other animals that follows, suggests that this rather philosophically oriented reflection introduces not only the subject matters discussed in book VII, but book VIII as well.

²⁵² As one would expect in a *historia*.

²⁵³ It's interesting that *êthos* was introduced as one of the four main forms of differentia in the *tupos*, but *trophê* was not.

Following this transitional statement, and picking up particularly on the use there of *êthos*, Aristotle proceeds by defending the study of *êthos* in animals other than humans by arguing that “traces of the ways of soul” are present even in animals.²⁵⁴

[16] For even the other animals mostly possess traces of the ways of soul, such as present differences more obviously in the case of humans. For tameness and wildness, gentleness and roughness, courage and cowardice, fears and boldness, temper and mischievousness are present in many of them together with resemblances of intelligent understanding, like the resemblances that we spoke of in the case of the bodily parts. For some characters differ by the more and less compared with man, as does man compared to the majority of animals (for certain characters of this kind are present to a greater degree in man, certain others to a greater degree in the other animals), while others differ by analogy: for corresponding to art, wisdom and intelligence in man, certain animals possess another natural capability of a certain sort. (588a18-31)

588a18 Ἔνεστι γὰρ ἐν τοῖς
πλείστοις καὶ τῶν ἄλλων ζώων ἵχνη τῶν περὶ τὴν ψυχὴν
a20 τρόπων, ἅπερ ἐπὶ τῶν ἀνθρώπων ἔχει φανερωτέρας τὰς δια-
φοράς· καὶ γὰρ ἡμερότης καὶ ἀγριότης, καὶ πραότης καὶ
χαλεπότης, καὶ ἀνδρία καὶ δειλία, καὶ φόβοι καὶ θάρρη,
καὶ θυμοὶ καὶ πανουργίαι καὶ τῆς περὶ τὴν διάνοιαν συνέσεως

²⁵⁴ See Lennox 1999 for an excellent discussion of *êthos* in animals compared to humans.

ἔνεισιν ἐν πολλοῖς αὐτῶν ὁμοιότητες, καθάπερ ἐπὶ τῶν με-
 a25 ρῶν ἐλέγομεν. Τὰ μὲν γὰρ τῷ μᾶλλον καὶ ἥττον διαφέρει
 πρὸς ἄλλοις ζώοις μᾶλλον), τὰ δὲ τῷ ἀνάλογον δια-
 φέρει· ὥς γὰρ ἐν ἀνθρώπῳ τέχνη καὶ σοφία καὶ σύνεσις,
 οὕτως ἐνίοις τῶν ζώων ἐστὶ τις ἑτέρα τοιαύτη φυσικὴ δύνα-
 μις.

Aristotle begins by claiming that “traces of the ways of soul” that are more obviously
 observed in humans are nonetheless present in other animals as well.²⁵⁵ As examples he offers
 the following:

tameness and wildness (*hēmerotês kai agriotês*)
 gentleness and roughness (*praotês kai chalepotês*)
 courage and cowardice (*andria kai deilia*)
 fears and boldness (*phoboi kai tharrê*)
 temper and mischievousness (*thumoi kai panourgia*)
 resemblances of intelligent understanding (*tês peri tēn dianoian suneseôs*
homoiotêtes)

Many of these traits are mentioned in the section of the *tupos* on *êthos*,²⁵⁶ but none of
 them are discussed in book VII. As we shall see, a similar list is offered in VIII.1.

²⁵⁵ Compare with the opening of book VIII, where Aristotle claims that *êthê* in “the less
 developed and shorter lived” animals are less apparent to perception compared to those of
 the longer-lived animals. See 608a11-13.

In the second half [16] Aristotle explicitly applies the topology of sameness and difference he developed in relation to the *parts* of animals in the *tupos* to the “ways of soul” discussed here. Recall that, in the earlier discussion, differing by the more or the less indicated a sameness in *genos* and a difference in *eidos*. These same relations hold between traits of character: some of the character traits exhibited by animals differ from those exhibited by humans by the more or the less, thus rendering the traits the same in *genos* but different in *eidos*, while other traits are only analogously similar.

The applicability of this topology of sameness and difference opens up the study of these features for scientific investigation, and puts them on a par, as it were, with the parts of animals. That is, since the activities and characters that manifest themselves in animals can be organized according to the modes of similarity and difference discussed earlier, we should be able to establish relationships between different kinds of animals based on the manner in which they possess these features, and, by so doing, potentially bring to light their causes.

Up to this point, Aristotle has not offered any *argument* in support of the notion that these traits of character/ways of soul are indeed exhibited by animals. It is not entirely clear that he owes us such an argument. It may be that careful observation of the relevant animals sufficiently substantiates his claim. However, he does proceed by offering an argument of sorts. By comparing the similar mental capacities of certain animals to human children, the claim that these character traits are in fact exhibited by many animals becomes more plausible:

²⁵⁶ Gentle (*praa*), 488b13; rough-tempered (*thumôdê*), 488b14; cowardly (*deilia*), 488b15; courageous (*andreia*), 488b17; wild (*agria*), 488b18; mischievous (*panourga*), 488b20.

[17] This kind of thing is clearest if we look at the age of childhood; for in children, though one can see as it were traces and seeds of the dispositions that they will have later, yet their soul at this period has practically no difference from that of wild animals, so that it is not illogical if some characters are the same in the other animals, while others are very like, and others are analogous. (588a31-b3)

588a31 Φανερώτατον δ' ἐστὶ τὸ τοιοῦτον ἐπὶ τὴν τῶν παίδων
ἡλικίαν βλέψασιν· ἐν τούτοις γὰρ τῶν μὲν ὕστερον ἔξεων
ἐσομένων ἔστιν ἰδεῖν οἶον ἵχνη καὶ σπέρματα, διαφέρει δ'
b1 οὐδὲν ὥς εἰπεῖν ἡ ψυχὴ τῆς τῶν θηρίων ψυχῆς κατὰ τὸν
χρόνον τοῦτον, ὥστ' οὐδὲν ἄλογον εἰ τὰ μὲν ταῦτ' αὐτὰ τὰ δὲ
παραπλήσια τὰ δ' ἀνάλογον ὑπάρχει τοῖς ἄλλοις ζώοις.

The argument, at its core, is that since the soul of a child is practically the same as that of a wild animal (*thêriôn*), it is “not unreasonable” (*ouk alogon*) that we should observe “traces” of the characteristics of soul in animals, just as we do in children. These traces, in children, are as “seeds,” which later develop, in maturity, into stable dispositions of character (*hexeis*). In animals, however, the implication seems to be that the traces are not seeds and do not develop further. However, they nonetheless are present, and they exhibit enough differentiation so as to merit further study.²⁵⁷

²⁵⁷ See Lennox 1999 for a close examination of this argument and a comparison with similar passages in *NE*. See also Leunissen 2013.

Following this defense of the study of *êthos* and the “ways of soul” in animals, Aristotle proceeds by arguing that it is possible to arrange living things along a near continuous scale of slight variation, representing an ever-increasing “possession of life” (*mallon . . . metetechein zôês, mallon zôên echonta*). Certain plants, Aristotle argues, when compared to more complex animals, seem as though they are inanimate, but when compared to actually inanimate things, these plants seem amazingly alive. Similarly, certain animals seem to be no more animate – “possess life” to no greater degree – than plants. But always, “little by little” one finds additional kinds of animals that appear to bridge the gap between the most simple and the most complex kinds.

Aristotle draws no notion of evolutionary development from this striking fact. Instead he uses it to strengthen and further secure his subject matter – the *bios*, *praxis*, and *êthos* of animals – as a topic of serious study. Since the gradation from higher to lower animals is nearly continuous, so also are the gradations in their activities and cognitive capacities. He offers activities related to generation as an example: most plants appear to have no other function (*ergon*) than producing seed and thus reproducing themselves; and indeed this function is shared by all (or almost all) living things. But, as he states, when sensation is added (i.e. when greater cognitive capacities are added) the activities surrounding their generation become more complex, e.g. more time is spent rearing and caring for the young. The message of the example is clear: animals that possess greater cognitive capabilities will show greater variety or sophistication in their activities, manners of life, and characters, but these forms of difference are nonetheless present even in the relatively “simple” animals, and are thus viable subjects of scientific study.

The example Aristotle uses, that of generation, was of course the subject matter of the previous two books. He now completes the transition to his new subject as follows:

[18] Now while one part of living consists for them in the activities to do with the producing of young, a further and different part consists in those to do with food; for these two objects in fact engage the efforts and lives of all animals. (589a2-5)

589a2

Ἐν μὲν

οὖν μέρος τῆς ζωῆς αἱ περὶ τὴν τεκνοποιίαν εἰσὶ πράξεις

αὐτοῖς, ἔτι δ' ἕτερον αἱ περὶ τὴν τροφήν· περὶ γὰρ δύο τοῦ-

a5

των αἱ τε σπουδαὶ τυγχάνουσιν οὔσαι πᾶσαι καὶ ὁ βίος.

The transition from generation to the gathering of food serves two purposes. First it begins the introduction to the next section, but second it ties the gradations in the activities relating to generation to those relating to food. Just as we observe the activities related to generation become more complex as the cognitive capacities of the animals in question increase (as was demonstrated in the preceding books), so also we might expect a similar complexity in the activities surrounding the gathering of food. And since feeding occupies as much of an animal's life as procreating (indeed, arguably more), we should expect the discussion to be an involved one.²⁵⁸

²⁵⁸ Recall that Aristotle *identifies* the nutritive and generative capacities of soul: both are capacities for producing an animal that is one in form with the "parent" (which, for the nutritive capacity, is the individual possessing soul). See *DA* II.4, 416a20ff.; *GA* II.1, 735a17ff.

But nutrition is not the first subject treated in book VII. Instead, the subject of nutrition leads to the further consideration that the food an animal eats is determined by the material out of which the animal's body is composed, its bodily blend or *krasis*:²⁵⁹

[19] And their food differs chiefly according to the matter out of which they are constituted. For each one's growth comes naturally out of the same matter. And what is natural is pleasant; and all pursue their natural pleasure. (589a5-9)

589a5

Αἰ

δὲ τροφαὶ διαφέρουσι μάλιστα κατὰ τὴν ὕλην ἐξ οἷας συν-
εστήκασιν. Ἡ γὰρ αὖξησης ἐκάστοις γίνεται κατὰ φύσιν ἐκ
ταύτης. Τὸ δὲ κατὰ φύσιν ἡδύ· διώκει δὲ πάντα τὴν κατὰ
φύσιν ἡδονήν.

This consideration, in turn, leads to a discussion of the characteristic environments in which animals live and spend most of their time. An animal's bodily blend matches or corresponds to the environment in which it lives, be that environment more watery, more earthy, etc. Thus a relationship exists between (1) the environment in which an animal lives, (2) the material blend of an animal's body, and (3) the food an animal characteristically eats. These topics form the core of the discussion in book VII.

²⁵⁹ As Allan Gotthelf pointed out, for Aristotle it is not that "you are what you eat" but rather that "you eat what you are!"

5.3.2.2 Introduction to *HA VIII*

Before turning to the main discussions of book VII, let us first compare the introduction to book VII with that of book VIII. For it too begins with a defense of the study of *êthos* in animals:

[20] The characters of animals are, among the less-developed and shorter-lived, less obvious to us by perception, but, among the longer-lived, more obvious. For they appear to have a certain natural capacity regarding each of the affections of the soul, regarding intelligence, stupidity, courage, and cowardice, and regarding tameness and ferocity, and the other dispositions of this sort. And some [animals] at the same time share in some learning and teaching, some from each other, others from humans, as many as have hearing, not just as many as [hear] sounds, but also those that distinguish the differences of signs. (608a11-21)

608a11 Τὰ δ' ἦθη τῶν ζώων ἐστὶ τῶν μὲν ἀμαυροτέρων καὶ
βραχυβιωτέρων ἥττον ἡμῖν ἔνδηλα κατὰ τὴν αἴσθησιν, τῶν
δὲ μακροβιωτέρων ἐνδηλότερα. Φαίνονται γὰρ ἔχοντά τινα
δύναμιν περὶ ἕκαστον τῶν τῆς ψυχῆς παθημάτων φυσικὴν,
a15 περὶ τε φρόνησιν καὶ εὐήθειαν καὶ ἀνδρείαν καὶ δειλίαν, περὶ
τε πραότητα καὶ χαλεπότητα καὶ τὰς ἄλλας τὰς τοιαύ-
τας ἕξεις. Ἐνια δὲ κοινωνεῖ τινὸς ἅμα καὶ μαθήσεως καὶ
διδασκαλίας, τὰ μὲν παρ' ἀλλήλων, τὰ δὲ καὶ παρὰ τῶν
ἀνθρώπων, ὅσαπερ ἀκοῆς μετέχει, μὴ μόνον ὅσα τῶν ψό-

a20 φων, ἀλλ’ ὅσα καὶ τῶν σημείων διαισθάνεται τὰς διαφο-
ράς.

Here again we have the claim that the *ethê* exhibited by animals are generally less apparent or obvious to us, though here in VIII.1 we are given the additional information that they are especially hard to discern in the “less developed and shorter lived” animals, and more easily recognized in the “longer lived.” What, in VII.1, were described as “traces of the ways of soul” are here referred to as “a certain natural capacity regarding each of the affections of soul,” but that the two phrases refer to the same things is shown by the list of examples provided. Recall in VII.1 a similar list was offered – here are both:

VII.1

tameness and wildness (*hêmerotês kai agriotês*)

gentleness and roughness (*praotês kai chalepotês*)

courage and cowardice (*andria kai deilia*)

fears and boldness (*phoboi kai tharrê*)

temper and mischievousness (*thumoi kai panourgia*)

resemblances of intelligent understanding (*tês peri tên dianoian suneseôs*

homoiotêtes)

VIII.1

intelligence and stupidity (*phronêsis kai euêtheia*)

courage and cowardice (*andreia kai deilia*)

tameness and ferocity (*praotêta kai chalepotêta*)

other dispositions of this sort (*tas toiautos hexeis*)

While these examples show that Aristotle has the same traits in mind, in VII.1 he seems to stop short of referring to these traits, as they appear in animals, as “dispositions” (*hexeis*), which he seems there, as elsewhere, to reserve for humans. Here in VIII.1 he does not hesitate to call them *hexeis*.²⁶⁰

Also, Aristotle makes the further observation in VIII.1 that some animals are receptive to a certain amount of learning and teaching. This is restricted to those animals that are not only capable of hearing sounds, but also of distinguishing “the differences of signs” (*tôn sêmaiôn . . . tas diphoras*).²⁶¹ While this information is of a piece with the observation in VII.1 that many animals possess “resemblances of intelligent understanding”, it nonetheless represents a new observation, and though the topic of teaching and learning amongst animals is not treated directly in book VIII, the many ways in which animals act intelligently (or seemingly intelligently) is.

In short, VIII.1 begins much as VII.1 did, with a defense of the study of *êthos* in animals. Why then is the discussion of *êthos* postponed to book VIII? Recall that VII.1 began with the observation that *bios* and *praxis* differ “according to” *êthos* and *trophê*. From the beginning these were the two main topics to be discussed. But, while it was clear that all animals need nutrition, and that different animals feed differently, it was perhaps not clear that all animals, or at least

²⁶⁰ See Lennox 1999, Leunissen 2013.

²⁶¹ See *Metaph.* A.1, 980b25ff.; below ch. 6, section 3.

most,²⁶² exhibit traits of character similar to those found in humans. The defense of the study of *êthos* in VII.1 led to the reflection on the near continuous gradations of change between animal kinds, and the manner by which their activities become more complex as their cognitive capacities increase. This in turn led to the consideration that together generation and feeding occupy most the time and energy of animals, and thus feeding, and its relationship to bodily blend and environment, was introduced as a topic to be discussed. The introduction to book VII sets the agenda for books VII and VIII.

5.3.3 Select Passages from *HA* VII and VIII

5.3.3.1 Feeding and nutrition (*HA* VII.2-11, 589b18-5496b20)

The discussion of feeding and nutrition in book VII proceeds more or less “up” through the *megista genê*, beginning with the *ostrakoderma*²⁶³ and moving through the bloodless animals to the blooded. Each section is characterized by the application of one or more differentiae of feeding to either the whole group or some division of the group. The most common feeding differentiae are: flesh-eating (*sarkophaga*, i.e. carnivores), plant or grass-eating (*poêphaga*, i.e. herbivores), and all-eating or *pamphaga* (this seems to extend beyond our notion of “omnivore”,

²⁶² Namely those with relatively higher cognitive capabilities. As Lennox points out to me, “sponges and sea cucumbers have relatively uninteresting characters.”

²⁶³ Throughout the dissertation I have chosen to use the transliterated Greek names for the following bloodless animals: *ostrakoderma* (“potshard-skinned,” i.e. testaceans), *malakostraka* (“soft-shelled,” i.e. crustaceans), *malakia* (“softies,” i.e. cephalopods). I’ve done so both because the referents of the terms we use today are generally not well known among people working in ancient philosophy (and thus little is lost using the Greek term), and by retaining the Greek it emphasizes the “name-like” nature of appellations, on which see Lennox 1991, n19, n24.

in so far as Aristotle reports that some such animals eat wood, stones, even dung). The discussion of feeding in birds includes the most varied of such attributes, including grub-eating, grain-eating, thorn-eating, and snipe-eating.²⁶⁴

In discussing a given attribute Aristotle often picks out the animals to which it belongs by using a second attribute. Often it seems there is a close connection between the two attributes, and it may be in this way that Aristotle points to or suggests possible causal relationships between attributes. Notably, it does NOT seem that the differentia selected to pick out certain animal kinds from the larger group is designated to *define* the kind so identified. Rather the extensional correlation of the attributes seems aimed at suggesting causal relations.

In what follows I look at three examples from the section on feeding: the *ostrakoderma*, birds, and four-footed live-bearers.

Ostrakoderma (590a19-b10)

The first kind of animal discussed are the *ostrakoderma*. In the discussion Aristotle divides the larger kind into those that are capable of locomotion (*kinêtika*), and those that are immobile (*akinêta*). The feeding attributes are then associated with this division: the immobile *ostrakoderma* feed on potable water, and the ones capable of motion feed on other animals and plants. What is the connection between the feeding attributes and those of locomotion? It seems clear that a flesh-eating animal could not survive (or survive well) if it were immobile: being

²⁶⁴ For evidence of their feeding habits Aristotle often looks to the sort of bait used to catch or capture the animal; this is especially true of the sea creatures. This seems to point to the source of at least some of Aristotle's information. Similarly, the discussion of four-footed live-bearing animals seems to be organized around wild and tame, and among the tame animals, information is provided by the shepherds and other professionals engaged in raising these domesticated animals.

mobile provides the conditions under which an animal can hunt and thus feed on other animals.²⁶⁵ The correlation of these attributes leads one to consider whether e.g. *being immobile* is a cause of feeding on potable water, or whether feeding on potable water obviates the need for locomotion in these animals, and thus is a cause of their being immobile.

It is of note that the similar differentiae *monima* (stationary) and *metabltika* (capable of movement) are discussed in the introductory *tupos*, as are the differentiae related to feeding. Nothing in either discussion suggests a causal priority of one over the other.²⁶⁶

Birds (592a29-594a1)

The discussion of birds is divided between land-dwelling and water-dwelling birds, though the division is not initially announced as such.²⁶⁷ Among the land-dwelling birds, the first picked-out are the crook-taloned birds (*gampsônuchoi*). These are immediately singled out as flesh-eaters (*sarkophaga*). Here again we find a correlation between attributes that seems to imply either a causal relationship or an underlying common cause. The connection between being *gampsonuchos* and *sarkophaga* is not further discussed here in *HA*, but it is explored at length in *PA* IV.12. There the *bios* of *gampsonuchos* birds explains the presence of their crook-talons; it is grounded in the need to over-powering and master other animals. Being flesh-eating seems to be a more primary aspect of these birds' lives, and is thus explanatory of their crook-talons.²⁶⁸

²⁶⁵ Aristotle does note that one immobile animal, the sea anemone, is a flesh-eater, feeding on whatever fish happens to approach its mouth, but it also feeds on potable water.

²⁶⁶ This is especially true of the related discussion in the *tupos*, where the topics are not even treated consecutively.

²⁶⁷ See Balme 1991, p. 105, note b.

²⁶⁸ See Lennox 2010b for a discussion of this chapter and the role of *bios* in explanation.

A number of other feeding differentiae are subsequently introduced (grub-eater, thorn-eater, sknipe-eater, grain-eater, herb-eater), with examples of kinds of birds that exhibit the differentiae. The pattern in this section is first to introduce the differentia of feeding, next to identify one or more kinds/forms of bird that exhibit the differentia, and finally to provide additional information about the birds so identified, perhaps to facilitate the actual identification of the bird in the wild. No indication is given that the differentia of feeding is an *essential* feature of the kind of bird identified, nor is it offered as a “specific difference,” i.e. one that would figure into a more complex definition of the kind of bird. Rather, the specific forms of bird are offered as mere examples of animals that exhibit the feature in question.

Four-footed live-bearing (594a25-596b10)

Interestingly, the discussion of the four-footed live-bearing animals appears to be divided first by the differentiae *wild* (*agria*) and *tame* (*hêmera*). The wild animals are discussed first, and it is immediately noted that all wild animals that are saw-toothed (*karcharodonta*) are flesh-eaters (*sarkophaga*). Examples include the wolf, bear, and lion. Similar to the discussion of feeding in birds, here the feeding differentia *sarkophaga* is correlated with another differentia (in this case *karcharodonta*), examples of animals are given, then additional information about these animals is provided. No definite causal relationship is specified between these differentiae, but, similar to the cases of *ostrakoderma* and birds, the reader is left to wonder if one might be the cause of the other. Also similar to the case of birds, in *PA* we find a more detailed account of why being *karcharodonta* is useful for eating flesh, and how this relates to the *bios* of such

animals.²⁶⁹ Flesh-eating again appears to be a more primary attribute of *bios*, and is thus explanatory of being saw-toothed.

These examples serve to illustrate that in the *HA* Aristotle often appears to offer correlations between attributes that he feels either are or are likely to be causally related in some important way. Exactly what is explanatory of what is not made clear, but what emerges is a complex picture of the interwoven relationship between these attributes, and suggests that understanding why a given animal exhibits a given attribute will require a deep acquaintance with the many facets of animal life.

Interestingly, the same attributes of feeding are discussed in the different *megista gene*, but no explicit effort is made to group these animals together as all being e.g. flesh-eaters. Rather being e.g. a flesh-eater appears to bring about different effects in different kinds of animals: *ostrakoderma* are often immobile, but those that are flesh-eaters are (mostly) mobile; birds have a beak rather than teeth and peculiar feet/toes, so flesh-eating affects the shape of their beak and their claws; four-footed live-bearing animals all have teeth, and flesh-eating requires those teeth to be saw-like. How does this sit with the discussion in *APo.* II.17 on the coextension of cause and effect? If I'm correct in suggesting that Aristotle views flesh-eating in these cases as a cause of the various other attributes discussed, then we have a case of the same cause bringing about different effects *in different kinds of animals*. The demands that flesh-eating put upon an animal vary with the specific kind of animal in question (and the bodily structures that are unique to those kinds), and thus the "effects" (i.e. the differentiation of attributes) brought about by flesh-eating varies across the kinds.

²⁶⁹ See *PA* III.1.

It is important to emphasize that Aristotle does not specifically employ causal language in these sections, and indeed perhaps consciously avoids it. However, given e.g. the related discussions in *PA*, as well as Aristotle's teleological view of explanation in animals, it is difficult to read these extensional correlations without seeing an underlying causal relationship at least being hinted at.

Note also, importantly, that in each case the differentiae that are picked out do not appear to be offered as *specific* differentiae, i.e. differentiae that properly divide the kind into *eidei*. The concern is not to define e.g. bears as saw-toothed flesh-eaters. Rather the interest appears to be in finding a way of dividing the larger kind into subgroups, all of which possess the feeding attribute in question. No suggestion is made that the subgroups that result from the division form any sort of ontologically privileged sub-kind. The focus is not on how one might go about grouping, ordering, or indeed defining kinds of animals, but rather on kinds of attributes and the relationships among them.²⁷⁰

5.3.3.2 Migration, hiding, and the shedding of skin (596b20-601a23)

This section of book VII is divided among the three topics listed in the heading: migration (*ektopizein*, 596b30-599a5), hiding (*phôlein*, 599a5-600b15), and the shedding of the "old age" (*ekdunô to gêras*, 600b15-601a23). It is introduced with the following comment:

[21] Their activities are all related both to mating and the raising of young, or to the supply of food, or are contrived against periods of cold and heat, or against the changing of the seasons. For all [animals] have an innate perception of change

²⁷⁰ Lennox stresses this in his 1990.

with respect to hot and cold, and just as among humans some move indoors during the winter, and others who command much land spend the summer in the cold parts and the winter in the warm sunny parts, so it is also with the animals that are capable of changing locations. And some find protection in their habitual places, while others migrate . . . (596b20-30)

596b20 Αἱ δὲ πράξεις αὐτῶν ἅπασαι περί τε τὰς ὀχείας
καὶ τὰς τεκνώσεις εἰσὶ, καὶ περὶ τὰς εὐπορίας τῆς τροφῆς,
καὶ πρὸς τὰ ψύχη καὶ τὰς ἀλέας πεπορισμέναι, καὶ πρὸς
τὰς μεταβολὰς τὰς τῶν ὥρων. Πάντα γὰρ τῆς κατὰ τὸ
θερμὸν καὶ ψυχρὸν μεταβολῆς αἴσθησιν ἔχει σύμφυτον,
b25 καὶ καθάπερ τῶν ἀνθρώπων οἱ μὲν εἰς τὰς οἰκίας τοῦ χει-
μῶνος μεταβάλλουσιν, οἱ δὲ πολλῆς χώρας κρατοῦντες θερί-
ζουσι μὲν ἐν τοῖς ψυχροῖς χειμάζουσι δ' ἐν τοῖς ἀλεεινοῖς,
οὕτω καὶ τῶν ζώων τὰ δυνάμενα μεταβάλλειν τοὺς τόπους.
Καὶ τὰ μὲν ἐν αὐτοῖς τοῖς συνήθεσι τόποις εὐρίσκεται τὰς
b30 βοηθείας, τὰ δ' ἐκτοπίζει . . .

In the first sentence Aristotle connects his current topic of discussion (protection from changes in cold and heat) with those that came before, namely activities pertaining to reproduction and feeding (the two areas that he claimed occupy most all of an animal's life). The comparison with humans moving indoors during the winter or to a cooler place in the summer serves to connect activities that are commonly recognized among humans with similar activities

found in other kinds of animals. In effect this is a specific instance of what was argued for in VII.1, namely that certain characteristics more commonly recognized in humans also are exhibited by other animals, and may serve as objects of scientific investigation.

The discussions are structured as follows:

Migration (596b30-599a5)

The discussion of migration begins with some general remarks, and then focuses specifically on birds (597a30-b30) and then fish (597b30-599a5).²⁷¹ The differences in migratory habits are generally not named by a single name (as in the case of e.g. feeding), but those discussed include migrating: shorter or longer distances, in flocks/schools or alone, during the day or at night (or both).

Of particular interest in this section is the explicitly causal language Aristotle uses regarding the various aspects of migration: the timing of migration aligns with seasonal changes *because* animals migrate to avoid excessive heat/cold, or to seek food, or both; weaker animals tend to have established migratory habits *for the sake of* preserving their more delicate constitutions, etc. This, of course, is markedly different compared to the lack of causal language elsewhere in *HA*.

But, even if the underlying causes of migration are clearly stated, the causes of many of the particular differences in migratory habits are not. For example, why do some birds or fish migrate great distances while others travel relatively short distances? Why do some migratory

²⁷¹ Perhaps because the distances travelled by birds and fish are more remarkable than most land animals?

animals travel in groups rather than alone?²⁷² No real effort is made to offer correlations between these attributes and other features. Instead a large part of this discussion is devoted to offering examples of forms of birds/fish that exhibit the migratory tendencies, and to provide additional details about these forms and the manner in which they are hunted.

Hiding (599a5-600b15)

The discussion of hiding is introduced by noting that many of the phenomena associated with migration occur with hiding. Specifically, animals tend to hide when the temperature becomes excessively hot (i.e. aestivation) or cold (i.e. hibernation), and come out when it becomes more moderate. This applies to land animals as well as to birds and fish. It is noted that in some cases entire kinds of animals hide (e.g. *ostrakoderma*), while in others some forms do and some do not. Similar to the section on migration, much of the discussion is devoted to identifying the forms of animals that do or do not hide, and few differentiae of hiding are offered. What is made clear is that hiding serves a similar purpose as migration.

Shedding of Outer Skin or “Old Age” (600b15-601a23)

The shedding of the outer skin or shell—what Aristotle refers to as the “old age”—is discussed primarily in relation to hiding: some animals that hide also cast the old age (primarily horny-scaled animals, insects, *ostrakoderma*, and *malokostraka*). This is not done in order to avoid excessive temperature (at least Aristotle does not say so), but rather is offered as a correlation with hiding, with no notion of causal relation implied.

²⁷² Interestingly, occasional reference is made to whether the flocks or schools have “leaders” (*hêgemonia*, 597b16, 598a30)—a facet of political organization discussed in the introductory *tupos* in I.1.

What is most striking about these sections is the explicit causal language used to account for the primary attributes under consideration (viz. migrating and hiding), and the lack of correlations made with the attributes of migrating and hiding. Beyond listing forms of animals as examples, Aristotle does not offer any other attributes that “follow” or are “followed by” these attributes. One might argue that this is because the cause is already known, however what is lacking is any account of why different kinds of animals migrate or hide *in the specific manner that they do* (e.g. short or long distances, in groups or alone, etc.), or indeed why some migrate or hide at all, while others do not.²⁷³

5.3.3.3 Friendship and enmity among animals (608b19-610b19)

The section on friendship and enmity or hostility among different kinds of animals is divided between land animals (608b19-610b1) and water animals (610b1-b20). Interestingly, similar to the preceding discussion of water and land animals in VII.2, Aristotle introduces this discussion with a comment on the causes of these attributes:

[22] So then there is war against each other among the animals, as many as occupy the same places and make their lives from the same things. For if food is scarce, even those of the same breed fight against each other . . . Further all are at war with the flesh-eaters, and these with the others, for their food is the animals . . . If food were not scarce, those that are now frightened and wild would act tamely both

²⁷³ Aristotle does note that certain “weak” (*asthenê*, 597a19) animals migrate, the implication being that their weakness necessitates that they escape the excessive heat or cold of the seasons, but does not emphasize or elaborate on this point.

610b33

Αἱ μὲν οὖν φιλίαι καὶ οἱ πόλε-
μοι τοῖς θηρίοις τούτοις διὰ τὰς τροφὰς καὶ τὸν βίον συμ-
βαίνουσιν.

Again the *dia* suggests that *trophê* and *bios* have causal priority over *philiai* and *polemoi*. The detailed information Aristotle offers in this section agrees with these causal claims. For example:

- The eagle and dragon snake are at war *because eagles eat snakes* (609a4)
- The poikilis, lark, pipra, and chloreus (all birds) are at war *because they eat each others' eggs* (609a7)
- The aigithos (a bird) and the ass are at war, *because the ass rubs itself on the thorn bushes that the aigithos nests in, and thus disrupts the eggs* (609a30)
- Birds that live at sea (e.g. brenthus, gull, harpe) are at war *because they feed on the same things* (609a24)
- The wolf is at war with the ass, bull, and fox *because it is a flesh-eater and thus feeds on these animals* (609b1)
- The raven and the fox are friends, *because the raven is at war with the merlin, which is at war with the fox (because it seeks to eat the fox's young)* (609b33)
- The laedos and the green woodpecker are friends *because they live in different places (the one in rocks and mountains, the other by rivers and thickets)*(610a10)

It seems, generally, that by being at “war” Aristotle means acting aggressively towards one another and seeking to kill one another, while “friendship” indicates, at best, ambivalence. Aristotle’s comment in [23] that both *trophê* and *bios* bring about war and friendship indicates that it is not only the fact that one animal eats another, or that both eat the same things, that causes war, but also the way of life associated with e.g. flesh-eating or living in a certain place (e.g. at sea, in the mountains, etc.). *Bios* in this sense determines (or partially determines?) the activities an animal engages in, and it is conflicts among such activities that bring about war.

Aristotle’s comment, early in this section, that the “dissociations and associations” of the “diviners” are actually based on war and friendship among animals, and due to the causes he identifies, may indicate that his purpose in this section is to provide a rational account for the relations among these animals that were previously noted and explained in more mystical ways.

5.3.4 Reflection of *HA* VII and VIII

The attributes discussed in these books vary greatly, but all fall under the major headings of *bios*, *praxis*, and *êthos*. The specific passages discussed above exhibit Aristotle’s interest in either documenting correlations among attributes that may point to causal relationships, or in explicitly calling out causal factors related to the attributes under consideration. As noted above, this latter tendency is unique to this section of the *historia*. Why Aristotle decided to cast the sections on hiding, migration, friendship, and war in causal terms, while sticking with the language of correlation in the section on feeding and nutrition is unclear. It may be that some of these passages were originally composed, in whole or part, as separate treatises that were not originally designed to appear in a *historia*, and thus did not avoid reference to causes.

6.0 *HISTORIA AND EMPEIRIA*

In the previous chapters I have discussed Aristotle's notion of *historia* and how the stage of investigation reported in a *historia* fits into Aristotle's views on inquiry, explanation, and demonstration. I've argued that a *historia* is a collection of *hoti*-level facts aimed at facilitating the discovery of causes, and thus at the transformation of *hoti*-level knowledge to *dioti*. In the methodological passage from *HA* I.6 and a related discussion in *APr.* I.30, Aristotle suggests that a *historia* provides the researcher with both the conclusions of demonstrations that are sought (i.e. the "problems" to be solved) as well as the premises that can be used to demonstrate those conclusions. But, given that the *historia* precedes the actual discovery of causes,²⁷⁴ it seems unlikely that at that stage of investigation the researcher will be able to identify which of the propositions established in the *historia* are the correct premises to use in an *apodeixis*. Thus if the *historia* supplies the researcher with the premises of demonstration, it does not identify them *as such*.

How is it that the investigator determines which propositions can successfully act as principles of demonstration? In this regard, Aristotle often emphasizes the importance of experience, or *empeiria*, in coming to know the relevant causes. This is especially so in so

²⁷⁴ As noted before, one must bear in mind the distinction between the stage of investigation that precedes the search for causes, and the composition of a treatise that reflects this stage. I've suggested above that Aristotle had in mind many of the causal relationships he posits between attributes in other treatises when he wrote the *HA*.

far as experience plays a key role in the cognitive process of formulating universal generalizations that ultimately become first principles. However, as I will argue below, Aristotle also used the notion of experience in a different, but related, manner, with reference not only to formulating the sort of universal generalizations that can act as first principles, but also in identifying them *as principles*. It is this sense of experience that connects with Aristotle's notion of *historia*, and understanding the relationship between the two sheds light on the manner in which a *historia* can aid in the identification of first principles, and thus causes, and the move from *hoti* to *dioti*.

6.1 *HISTORIA AND EMPEIRIA*

Our first task is to motivate the idea that for Aristotle there is an important connection between the notions of *historia* and *empeiria*. Let us begin by looking again at the important methodological passage in *HA* I.6. Recall what Aristotle says there:

- [1] These things have now been said in this way as an outline, for the sake of a taste of how many and what sort of things must be studied; we shall speak with precision later, in order that we should first grasp the existing differences and attributes for all. After this we must attempt to discover the causes of these; for this is the natural way to conduct an investigation, the *historia* regarding each thing being complete. For both the about-which-

things and the from-which-things that demonstration must be come to be clear from these things. (HA I.1, 491a7-14)

491a7 Ταῦτα μὲν οὖν τοῦτον τὸν τρόπον εἴρηται νῦν ὥς ἐν
τύπῳ, γεύματος χάριν περὶ ὅσων καὶ ὅσα θεωρητέον· δι'
ἀκριβείας δ' ὕστερον ἐροῦμεν, ἵνα πρῶτον τὰς ὑπαρχούσας
a10 διαφορὰς καὶ τὰ συμβεβηκότα πᾶσι λαμβάνωμεν. Μετὰ δὲ
τοῦτο τὰς αἰτίας τούτων πειρατέον εὑρεῖν. Οὕτω γὰρ κατὰ φύ-
σιν ἐστὶ ποιεῖσθαι τὴν μέθοδον, ὑπαρχούσης τῆς ἱστορίας τῆς
περὶ ἕκαστον· περὶ ὧν τε γὰρ καὶ ἐξ ὧν εἶναι δεῖ τὴν ἀπό-
δειξιν, ἐκ τούτων γίνεται φανερόν.

Note especially Aristotle's comments near the end of the passage, where he states that both the *peri hōn* and *ex hōn* of *apodeixis* come to be clear from the work done in the *historia*. Previously I argued that by *peri hōn* Aristotle is referring to the conclusions of demonstrations (i.e. the conclusion is that "about which" a demonstration is), and by *ex hōn* he is referring to the premises of demonstrations (i.e. the premises are those things "from which" a demonstration proceeds). Thus the *historia* provides both the conclusions of apodeictic demonstrations, as well as their premises. But Aristotle's comments here make it clear that the *historia* precedes the actual discovery of causes.²⁷⁵ Thus if the *historia*

²⁷⁵ This is at least true for the "logical" relationship between the report of the facts (*historia*) and the demonstration of their causes. That the actual composition of any given *historia* chronologically precedes the composition of a treatise on causes is never assured, and, in the case of *HA*, is very much in question.

makes the *ex hōn* of demonstration clear, then it does so in such a manner as to fall short of identifying the premises of a demonstration *as such*, i.e. as the causally relevant premises relative to the conclusion. Put another way, the *historia* may reveal which propositions can serve as principles, but does not identify them *as principles*.²⁷⁶ I argued earlier²⁷⁷ that the process by which *hoti*-level facts are established by the investigator of nature bares close similarity to the process by which first principles are grasped. Both seem to be instances of *epagogê*, the difference being, in the one case, that the investigator recognizes that the fact so established may be explained further (i.e. is a mediated fact), and in the other, that the fact established is an immediate, indemonstrable, first principle. This suggests that the recognition of a principle as a principle involves something more than the mere establishing of the *hoti*-level fact via *epagogê*.²⁷⁸ I shall consider what that “something more” is below.

This understanding of *historia* relative to the principles of *apodeixis* agrees with the related discussion of these matters in *APr.* I.27-30. There Aristotle provides an algorithmic procedure for identifying middle terms that can connect major and minor terms in deductions. In short, the method consists in first identifying the major and minor terms of a given “problem,” then finding all the terms that follow the major term, and all the terms that are followed by the minor, and finally comparing the lists in order to identify any common terms. These common terms can then be used as middle terms in deductions

²⁷⁶ Did Aristotle himself recognize this distinction? Many commentators believe he did (e.g. Kosman 1973, Charles 2000, Bronstein 2010), though agreement is not universal.

²⁷⁷ See ch. 3, section 3.2.1.

²⁷⁸ The question of how, on Aristotle’s account, first principles gain their epistemic warrant is much debated in the literature (e.g. Kosman 1973, Burnyeat 1981, Irwin 1990, Frede 1996, , Ferejohn 2009, etc.), and is often cast in “rationalist/empiricist” language. As will be seen below, I tend towards an “empiricist” interpretation, largely in line with Kosman.

connecting the major and minor terms. Aristotle characterizes the stage at which these many facts regarding the various terms and their connections with the major and minor terms are collected as a *historia*. He writes:

- [2] Consequently, if the facts concerning any subject have been grasped, we are already prepared to bring the demonstrations readily to light. For if nothing that truly belongs to the subjects has been left out of our *historia*, then concerning every fact, if a demonstration for it exists, we will be able to find that demonstration and demonstrate it, while if it does not naturally have a demonstration, we will be able to make that evident. (*APr.* I.30, 46a17-27, trans. Smith)

ὥστ' ἐὰν ληφθῇ

τὰ ὑπάρχοντα περὶ ἕκαστον, ἡμέτερον ἤδη τὰς ἀποδείξεις
ἐτοίμως ἐμφανίζειν. εἰ γὰρ μηδὲν κατὰ τὴν ἱστορίαν παρα-
a25 λειφθείη τῶν ἀληθῶς ὑπαρχόντων τοῖς πράγμασιν, ἔξομεν
περὶ ἅπαντος οὗ μὲν ἔστιν ἀπόδειξις, ταύτην εὐρεῖν καὶ ἀπο-
δεικνύναι, οὗ δὲ μὴ πέφυκεν ἀπόδειξις, τοῦτο ποιεῖν φανερόν.

As long as “nothing that truly belongs to the subjects has been left out of our *historia*,” i.e. as long as all the relevant facts regarding the major and minor terms are included, then we will be in a position to determine whether a deduction can be formed or not. However, nothing in the formula for identifying middle terms guarantees that the

middle term so identified is the true cause of the minor term inhering in the major, and thus nothing guarantees that the deduction so formed qualifies as an *apodeixis* in the strict sense.²⁷⁹

There is evidence, however, that Aristotle recognizes this. Immediately prior to passage [2] above he writes:

[3] The majority of principles for each science are peculiar to it. Consequently, it is for our experiences (*empeirias*) concerning each subject to provide the principles. I mean, for instance, that it is for astronomical experience to provide the principles of the science of astronomy (for when the appearances had been sufficiently grasped, in this way astronomical demonstrations were discovered; and it is also similar concerning any other art or science whatsoever).

46a17 ἴδιαι δὲ καθ' ἐκάστην αἱ πλεῖσται. διὸ τὰς
μὲν ἀρχὰς τὰς περὶ ἕκαστον ἐμπειρίας ἐστὶ παραδοῦναι,
λέγω δ' οἷον τὴν ἀστρολογικὴν μὲν ἐμπειρίαν τῆς ἀστρολογι-
a20 κῆς ἐπιστήμης (ληφθέντων γὰρ ἱκανῶς τῶν φαινομένων οὕτως
εὗρέθησαν αἱ ἀστρολογικαὶ ἀποδείξεις), ὁμοίως δὲ καὶ περὶ
ἄλλην ὅποιαν οὖν ἔχει τέχνην τε καὶ ἐπιστήμην.

²⁷⁹ See Lennox 1991, pp. 44-5, where he describes the procedure as providing a “short-list” of possible explanatory middle terms.

This passage highlights the role of experience (*empeiria*) in coming to know the principles of a science. Here experience is correlated with (equated to?) a comprehensive knowledge of the facts of a domain of study. As Aristotle states, it is only when the “appearances”²⁸⁰ have been sufficiently grasped, i.e. in all their multitudinous variety, that the principles were discovered. And as passage [2], which follows this one, makes clear, a sufficient grasp of the phenomena is achieved in a completed *historia*.

These considerations suggest that the gap left between grasping the propositions that can serve as principles of demonstration, and recognizing them as such, is filled (at least in part?) by *empeiria*. The *historia* both collects the propositions, and aids in the identification of the explanatory relationships between the relevant terms by providing the reader with experience, understood (at least at this preliminary stage) as a sort of comprehensive grasp of the subject matter at hand.

6.2 APODEIXIS, ARCHAI, AND EMPEIRIA

Elsewhere in the corpus, especially in *APo.* II.19 and *Metaph.* A.1, Aristotle outlines a role for *empeiria* in coming to know first principles, a role that is significantly different

²⁸⁰ It is likely that the term *phainomena* was used in a rather technical sense with reference to astronomy. Euclid’s work on astronomy is titled *Phainomena*. This technical sense presumably is comparable to the more general sense of “grasping the appearances” relative to any field of study, however determining what counts as a relevant “appearance,” i.e. which facts are the important ones to note, is not entirely clear. In astronomy, these would be the positions of the various celestial bodies at different times. In other fields, it seems that knowing the facts, and knowing which are likely to be the important facts, are both products of experience.

from the one briefly sketched above. In this section I examine the relevant passages from these works and consider them in light of the previous discussion.

As has been discussed earlier in this dissertation, according to Aristotle knowledge, in the fullest sense of the term, results from the possession of a demonstration that reveals the cause of what is to be understood. The ultimate premises of such demonstrations are themselves indemonstrable starting points or first principles. Since our knowledge of such principles cannot be the product of demonstration, there must be another means for arriving at such knowledge. Repeatedly in *APo.* Aristotle hints at such an alternative means of grasping first principles, and finally, in *APo.* II.19, he takes up the matter directly. The chapter has been much debated in the scholarly literature, but a detailed engagement with these scholarly debates is not necessary for our current purposes. Rather I would like simply to call to our attention the role Aristotle claims that experience (*empeiria*) plays in our acquisition of first principles, and consider that role in light of the discussion of experience in section (2) above.

In *APo.* II.19, having laid out the problem of how we can come to know a principle that is indemonstrable, given that causal demonstration has been put forward as the standard by which we can be said to know in the fullest and most strict sense, Aristotle outlines a process whereby human beings can move from knowledge of particulars to knowledge of universals.²⁸¹ The process begins with perception, which he describes as an “innate discriminatory capacity” (*dunamin sumphuton kritikên*). In animals that

²⁸¹ Does this process result in the formation of universal *concepts* or *propositions*? Or does the formation of a universal concept entail/imply the formation of certain propositions? The scholarly literature is divided on the issue. On my reading, especially in light of *APo.* I.1-2, the focus must be on propositions, given that establishing if a thing exists (*to ei esti*) involves establishing that a certain subject exhibits a certain attribute.

additionally have the capacity for memory, perceptions are retained and stored as “traces” in the soul, as Aristotle elsewhere describes them. Such animals, by dint of their faculty of memory, can have knowledge (*gnôsis*) even when they are not actively perceiving, presumably by attending to the memory of past perceptions. And for a select few animals (likely only human beings), the retention of these past perceptions in memory can give rise to a reasoned account (*logos*). But prior to that happening, Aristotle outlines an additional cognitive state that follows upon memory, but precedes the acquisition of the reasoned account. This middle state he calls experience (*empeiria*):

[4] So then from perception memory comes to be, as we say, and from repeated memories of the same thing, experience (*empeiria*); for numerically many memories are/form a single experience. And from experience, or from all of the universal that has settled in the soul, the one besides the many, which would be the same one in all these, there arises a principle of art (*technê*) and understanding (*epistêmê*): if it is regarding that which comes to be, art, and if it is about being, understanding. (*Apo.* II.19, 100a3-10)

100a3 Ἐκ μὲν οὖν αἰσθήσεως γίνεται μνήμη,
ὥσπερ λέγομεν, ἐκ δὲ μνήμης πολλάκις τοῦ αὐτοῦ γινομέ-
a5 νης ἐμπειρία· αἱ γὰρ πολλαὶ μνήμαι τῷ ἀριθμῷ ἐμπειρία
μία ἐστίν. ἐκ δ' ἐμπειρίας ἢ ἐκ παντὸς ἡρεμήσαντος τοῦ κα-
θόλου ἐν τῇ ψυχῇ, τοῦ ἐνὸς παρὰ τὰ πολλά, ὃ ἂν ἐν ἅπα-
σιν ἐν ἐνῇ ἐκείνοις τὸ αὐτό, τέχνης ἀρχὴ καὶ ἐπιστήμης,

ἐὰν μὲν περὶ γένεσιν, τέχνης, ἐὰν δὲ περὶ τὸ ὄν, ἐπιστήμης.

While nearly every word of this passage has been debated in the literature, one may conclude without great objection that in this passage Aristotle sees experience as occupying a sort of middle ground between *aisthêsis* and *nous*, i.e. the cognitive state that grasps first principles. The capacity for experience (which Aristotle says most animals either totally lack or possess in a minimal way) seems vital to the process whereby the traces of perceptions stored in memory give rise to our grasp of principles, but precisely how experience functions in this regard is not clearly stated. Experience seems to transcend the particular nature of perception,²⁸² and yet fall short of the universal nature of *nous*.²⁸³

How one interprets the role of experience in this process depends in part on how one interprets the “or” (ἢ) in 100a6.²⁸⁴ Is it epexegetical, glossing what is meant by experience? Is it corrective, describing a related, but different, state than experience? Is it simply disjunctive? The text here in *APo.* II.19 largely underdetermines the issue, but a related text, in *Metaph.* A.1 may help. The *legomen* in 100a4 may very well be a reference to *Metaph.* A.1, where Aristotle discusses this very process at greater length. The context of that discussion regards the acquisition of wisdom (*sophia*), which Aristotle argues is the knowledge of principles and causes. In a manner similar to *APo.* II.19, he argues that

²⁸² But what of the comment in *APo.* II.19 that “although you perceive particulars, perception is of universals”?

²⁸³ Indeed experience seems to fall short of any form of universal knowledge, not just knowledge of first principles grasped by *nous*.

²⁸⁴ See Barnes (1993), p. 264; Charles (2000), pp. 149ff.; Hasper and Yurdin (2010); Salmieri (2010), pp. 181ff.

experience results from the memory of multiple perceptions, and that it is from experience that human beings derive “art” (*technê*) and “reasoning” (*logismos*):

[5] So the other animals live by images and memories, but have a small share of experience, but the human race lives also by art and reasoning. And for human beings, experience arises from memory, since many memories of the same thing bring to completion a capacity for one experience.

980b25

τὰ

μὲν οὖν ἄλλα ταῖς φαντασίαις ζῇ καὶ ταῖς μνήμαις, ἐμ-
πειρίας δὲ μετέχει μικρόν· τὸ δὲ τῶν ἀνθρώπων γένος καὶ
τέχνη καὶ λογισμοῖς· γίγνεται δ’ ἐκ τῆς μνήμης ἐμπειρία
τοῖς ἀνθρώποις· αἱ γὰρ πολλαὶ μνήμαι τοῦ αὐτοῦ πράγμα-

981a1

τος μιᾶς ἐμπειρίας δύναμιν ἀποτελοῦσιν.

Here we find a similar account of a plurality of memories giving rise to experience, only here it is specified that it is many memories “of the same thing” (*tou autou pragmatos*) that go into forming a single experience. Ultimately, as Aristotle will make clear further on, it is the recognition of what is similar in the multiple memories that forms the core of the knowledge or principle that emerges from the particular perceptions, but the experience that arises from the multiple memories appears to fall short of the actual recognition of what is similar. Indeed, just as memory mediates the relationship between perception and experience, so to it seems that experience mediates memory and *nous*. Indeed Aristotle

[6] Now experience seems to be almost the same thing as knowledge (*epistêmê*) or art, but for human beings, knowledge and art arise from experience, for experience makes art, as Polus says, but inexperience makes chance. And art comes into being whenever, out of many conceptions from experience, one universal judgment arises about those that are similar.

Just as many particular perceptions of the same thing somehow give rise to a single experience, so too many “conceptions from experience” (*tês empeirias ennoêmatôn*) give rise to one universal judgment concerning like things. However this does little to clarify precisely the cognitive advance that experience has over perception (and knowledge has over experience).

[7] Nevertheless we think that knowing and understanding are present in art more than in experience and we take the possessors of arts to be wiser than people with experience, as though in every instance wisdom is more something resulting from and following along with knowing; and this is because the ones know the cause while the others do not. For people with experience know the fact (*to hoti*), but do not know the reason why (*to dioti*), but the others are acquainted with the reason why and the cause.

²⁸⁵ On this, and generally the relationship between memory, experience, and knowledge, see Machamer 2001.

Here Aristotle claims that the person with experience knows *that* (*hoti*) certain things are the case (such that e.g. she may direct her actions appropriately), but does not know *why* (*dioti*) they are the case, i.e. does not know the causes. The appearance of *hoti* and *dioti* in this passage, and the correlative association of *dioti* with knowledge of causes, appears to connect Aristotle's discussions of *empeiria* with the notion of *historia*. The person with experience knows *to hoti* but not *to dioti*, just as the *historia* is a collection of *hoti*-level facts that is aimed at facilitating the discovery of, but does not yet achieve, *dioti*-level knowledge.

However the connection is not perfect. As it is described in *APo.* II.1-2, *to hoti* represents a *universal* proposition of the form *AaB*, while *to dioti* expresses the reason why such a proposition is the case, i.e. expresses the causal middle term that connects *A* with *B*. But the discussions of *empeiria* in *APo.* II.19 and *Metaph.* A.1 seem to make clear that the person with experience does not yet grasp the universal that embraces the particulars from perception.

Aristotle illustrates the relationship between experience and art or knowledge in A.1 with the familiar example of the doctor treating Socrates and Callias. He states:

[8] For to have a judgment that this thing was beneficial to Callias when he was sick with this disease, and to Socrates, and one by one in this way to many people, belongs to experience. But the judgment that it was beneficial to all such people, marked out as being of one form, when they were sick with this

disease, such as to phlegmatic or bilious people, when they were feverish with heat, belongs to art.

981a7

τὸ μὲν γὰρ ἔχειν ὑπόληψιν ὅτι

Καλλία κάμνοντι τηνδὶ τὴν νόσον τοδὶ συνήνεγκε καὶ

Σωκράτει καὶ καθ' ἕκαστον οὕτω πολλοῖς, ἐμπειρίας ἐστίν·

τὸ δ' ὅτι πᾶσι τοῖς τοιοῖσδε κατ' εἶδος ἐν ἀφορισθεῖσι,

κάμνουσι τηνδὶ τὴν νόσον, συνήνεγκεν, οἷον τοῖς φλεγματώ-

δεσιν ἢ χολώδεσι [ἢ] πυρέττουσι καύσῳ, τέχνης.

In this passage, the doctor with only experience as a guide recognizes that a certain treatment was successful for a number of people with a given disease, but fails to recognize what it is that these people have in common, by dint of which the treatment was successful. Thus the doctor with only experience grasps *that* the treatment was successful in these various cases, but not *why* it was. According to the example, the reason why the treatment was successful is that the patients share some attribute that for some reason renders the treatment efficacious (e.g. they are all phlegmatic or bilious).

Notice that this sort of explanation is what Lennox describes as an “A-type” explanation: it locates each individual subject within a wider kind, to which the predicate in question belongs *per se*. It is *in so far as* Calias, Socrates, etc. are e.g. phlegmatic that the treatment is effective. The doctor with experience alone does not grasp this common feature that groups the patients together, but nonetheless knows that in the past the treatment was effective for other patients with the given disease, and perhaps even has a

sense that the present patient is either similar or dissimilar to the past cases, though is unable to enunciate precisely how. So understood, the person with experience does not grasp *to hoti*, at least not in the manner in which *to hoti* was interpreted earlier. What the person with experience does grasp is *the particular*, i.e. she grasps that several particular propositions are true, without being able to formulate the universal proposition that embraces all the particulars.²⁸⁶ But grasping the universal in this case would amount to grasping *to hoti*, as the term was understood in e.g. *APo.* II.1, and as it was developed relative to the notion of *historia*.

Thus Aristotle appears to vary in his usage of the term *to hoti*, such that its use in this passage, and thus the putative connection between *empeiria* and *historia*, seems doubtful. Indeed, the sense of *empeiria* developed in *APo.* II.19 and *Metaph.* A.1 does not seem to correspond with the way in which the term was used in passage [3] from *APr.* I.30.²⁸⁷ While in the one case *empeiria* was described as a sort of cognitive state that stands midway between perception and knowledge, in the other it seems to indicate a thorough and comprehensive grasp of the (universal) facts related to a domain of study. It is this second sense of *empeiria* that bears on the notion of *historia*, and though it differs from the famous and contentious uses of the term in *APo.* II.19 and *Metaph.* A.1, I believe Aristotle's

²⁸⁶ The situation is perhaps more complicated, since passage [6] above suggests that the one with experience is able to formulate "conceptions" (*enoma*), which seem to fall short of propositional knowledge of universals, but exceed the knowledge of particulars.

²⁸⁷ It is possible to interpret passage [3] from *APr.* I.30 as stating that it was only when each *particular* astronomical phenomena was grasped (e.g. the phenomena associated with Mars *at this time*, Venus *at this time*, etc.) that the universal principles were achieved. In this way the experienced astronomer would be in a similar position as the experienced doctor, grasping the particulars but failing to see the universal that embraces them.

other uses of the notion of experience (and inexperience) elsewhere in the corpus provide the link to the notion of *historia*.

6.3 TWO SENSES OF *EMPEIRIA*

In the sections above I have discussed Aristotle's notion of experience and the role it plays in establishing first principles, in so far as experience is a necessary stage along the way to forming universal generalizations from perception. However, I also have the sense that when, in passage [3] from *APr.* I.30, Aristotle states that experience is necessary for discovering the principles that are peculiar to each science, he is also intimating that our experience with a subject matter will help us develop a sense of what counts as a cause in the given field of study, and thus what is capable of explaining the presence of other features. Experience in this sense corresponds more closely to the comprehensive knowledge of a field of study embodied in a *historia*.

There are a number of passages that suggest that experience aids in identifying first principles because it provides us with a grasp of many different relevant facts, and that our grasp of a putative first principle is strengthened when we see it explain many of these facts—when we come to recognize its explanatory power.²⁸⁸ For example, in *GC* I.2 Aristotle states:

[9] Inexperience is a cause of the relative inability to comprehend the admitted facts. Wherefore those who have dwelt more among natural things are better

²⁸⁸ This is the view defended in Kosman 1973.

able to postulate principles of the sort that can connect many things together; while those who, from engaging in many arguments, have failed to study things as they are, readily show themselves capable of seeing very little. (*GC* I.2, 316a5-10; trans. Joachim)

316a5 Αἴτιον δὲ τοῦ ἐπ' ἔλαττον δύνασθαι τὰ ὁμολογούμενα συνορᾶν (5)
 ἢ ἀπειρία. Διὸ ὅσοι ἐνφκῆκασι μᾶλλον ἐν τοῖς φυσικοῖς
 μᾶλλον δύνανται ὑποτίθεσθαι τοιαύτας ἀρχὰς αἱ ἐπὶ πολὺ
 δύνανται συνείρειν· οἱ δ' ἐκ τῶν πολλῶν λόγων ἀθεώρητοι
 τῶν ὑπαρχόντων ὄντες, πρὸς ὀλίγα βλέψαντες, ἀποφαίνον-
a10 ται ῥᾶον.

According to this passage, people with experience are better able to set down principles that are capable of explaining many things, and I take it this is a sign that they are in fact hitting on the true principles. I take it also that experienced people are able to do this because of their vast knowledge of many relevant facts.

This idea is substantiated by a passage in *DA* I.1:

[10] Knowledge of a thing's essential nature is of course a valuable assistance towards the examination of the causes of its attributes . . . But the converse is also true; the attributes contribute materially to the knowledge of what a thing is. For when we are in a position to expound all or most of the

attributes as presented to us, we shall also be best qualified to speak about the essence. For the starting-point of every demonstration is the statement of the subject's essential nature, and definitions which do not enable us to know the attributes, or even to make a tolerable guess about them, are clearly laid down merely for argument's sake and are utterly valueless. (*DA* I.1, 402b16-28; trans. Sachs)

402b16

ἔοικε δ'

οὐ μόνον τὸ τί ἐστὶ γινῶναι χρήσιμον εἶναι πρὸς τὸ θεωρῆσαι

τὰς αἰτίας τῶν συμβεβηκότων ταῖς οὐσίαις (ὥσπερ ἐν τοῖς

μαθήμασι τί τὸ εὐθὺ καὶ τὸ καμπύλον, ἢ τί γραμμὴ καὶ ἐπί-

b20

πεδον, πρὸς τὸ κατιδεῖν πόσαις ὀρθαῖς αἰ τοῦ τριγώνου γωνίαι

ἴσαι), ἀλλὰ καὶ ἀνάπαλιν τὰ συμβεβηκότα συμβάλλεται

μέγα μέρος πρὸς τὸ εἰδέναι τὸ τί ἐστίν· ἐπειδὴν γὰρ ἔχω-

μεν ἀποδιδόναι κατὰ τὴν φαντασίαν περὶ τῶν συμβεβηκό-

των, ἢ πάντων ἢ τῶν πλείστων, τότε καὶ περὶ τῆς οὐσίας

b25

ἔξομεν λέγειν κάλλιστα· πάσης γὰρ ἀποδείξεως ἀρχὴ τὸ

τί ἐστίν, ὥστε καθ' ὅσους τῶν ὀρισμῶν μὴ συμβαίνει τὰ συμ-

403a1

βεβηκότα γνωρίζειν, ἀλλὰ μὴδ' εἰκάσαι περὶ αὐτῶν εὐ-

μαρές, δῆλον ὅτι διαλεκτικῶς εἴρηνται καὶ κενῶς ἅπαντες.

Here the claim is that extensive knowledge of a thing's non-essential attributes will put us in a better position to hypothesize regarding its essential attributes, because we will be in a better position to see whether a putative first principles can explain the many facts we know. Such extensive knowledge of a thing's attributes is provided by the *historia*, and this seems very much to me to be what Aristotle referred to above as experience.

Both these examples suggest that greater experience leads to a more comprehensive grasp of the facts pertaining to a field of study, and thus allows us to test possible explanatory principles against a wider array of data. Our belief or conviction in a putative first principle *as a principle* is thus strengthened by witnessing it explain many different facts. Thus this conviction requires experience, as Aristotle explains in this passage from the *EN*:

[11] A sign of what is being said is why young people become skilled geometricians and mathematicians, and wise in respect of such things, but they do not seem to become possessed of practical judgment, and the reason is that practical judgment has to do with particulars, which become known by experience, but the young are not experienced, since it is length of time that produces experience. And then one might consider this, why it is that a child might become a mathematician, but not wise or knowledgeable about nature. Is it not because things of the one sort come from abstraction, while the principles of things of the other sort come from experience? The young are not convinced of the latter, but talk about them, but what the former things are is not unclear. (*EN* VI.8, 1142a12-25; trans. Sachs, modified)

1142a11

σημεῖον δ' ἐστὶ τοῦ εἰρημένου

καὶ διότι γεωμετρικοὶ μὲν νέοι καὶ μαθηματικοὶ γίνονται

καὶ σοφοὶ τὰ τοιαῦτα, φρόνιμος δ' οὐ δοκεῖ γίνεσθαι.

αἴτιον δ' ὅτι καὶ τῶν καθ' ἑκάστῃ ἐστὶν ἡ φρόνησις, ἃ γίνεται

a15

γνώριμα ἐξ ἐμπειρίας, νέος δ' ἔμπειρος οὐκ ἔστιν· πλῆθος

γὰρ χρόνου ποιεῖ τὴν ἐμπειρίαν· ἐπεὶ καὶ τοῦτ' ἂν τις σκέ-

ψαιτο, διὰ τί δὴ μαθηματικὸς μὲν παῖς γένοιτ' ἂν, σο-

φός δ' ἢ φυσικὸς οὔ. ἢ ὅτι τὰ μὲν δι' ἀφαιρέσεώς ἐστιν,

τῶν δ' αἱ ἀρχαὶ ἐξ ἐμπειρίας· καὶ τὰ μὲν οὐ πιστεύουσιν

a20

οἱ νέοι ἀλλὰ λέγουσιν, τῶν δὲ τὸ τί ἐστὶν οὐκ ἄδηλον;

Experience gives the mature practitioner of a science a higher level of conviction or belief (the verb is derived from *pistis*) in the principles. On the one hand, this may be greater conviction in the fact expressed by the principle, in so far as additional experience strengthens the inductive justification of the fact, but also it leads to greater conviction in the principle *as a principle*.

Thus the *historia*, and the experience that underlies it, provides a wide set of data upon which explanatory principles may be tested, and thus aids in our grasp of principles as principles.

In other examples, it seems that a lack of experience causes problems because it results in a lack of knowledge of specific, important facts pertinent to a domain of study. The point here is not so much that we are at risk of accepting a principle prior to testing it against a wide array of data, but rather that inexperience leads to ignorance of certain, important facts that would immediately speak against certain explanations.

For example, in criticizing his predecessor's views on respiration in animals, Aristotle states:

[12] A few of the earlier natural philosophers have dealt with respiration; some of them have offered no explanation why this phenomenon occurs in living creatures; others have discussed it without much insight, and with insufficient experience of the facts. Again, they say that all living creatures breathe; but that is not true. (*Resp.* 1, 470b6-10; trans. Hett)

470b6 Περὶ γὰρ ἀναπνοῆς ὀλίγοι μὲν τινες τῶν πρότερον φυ-
σικῶν εἰρήκασιν· τίνος μέντοι χάριν ὑπάρχει τοῖς ζῴοις,
οἱ μὲν οὐδὲν ἀπεφύγαντο, οἱ δὲ εἰρήκασιν μὲν, οὐ καλῶς δ'
εἰρήκασιν ἀλλ' ἀπειροτέρως τῶν συμβαινόντων. ἔτι δὲ πάντα
b10 τὰ ζῷα φασιν ἀναπνεῖν· τοῦτο δ' οὐκ ἔστιν ἀληθές. ὥστ' ἀναγ-
καῖον περὶ τούτων πρῶτον ἐπελθεῖν, ὅπως μὴ δοκῶμεν ἀπ-
όντων κενὴν κατηγορεῖν.

In the first place, these earlier natural philosophers erred in so far as they assumed that all animals respire, which, as Aristotle points out, is not true. Had they known this, then presumably their account of respiration would have differed significantly. Aristotle goes on to argue that their ignorance with regard to the internal anatomy of animals also led them astray. Some of his predecessors believed that fish are able to take in air from the water through their mouths, as other, respiring animals do. But this would do a fish little good, Aristotle points out, since in fish

the passage from the mouth leads directly to the stomach, and, in any event, fish do not have lungs.

So a lack of experience leads to ignorance regarding important facts that would materially affect the sorts of explanations one might attempt to formulate.

A similar diagnosis of the failure of earlier natural philosophers due to inexperience emerges from a discussion in the *GA* regarding the generation of certain kinds of fish. It was believed by some that certain kinds of fish are impregnated by swallowing the milt (i.e. spermatic residue) emitted by the male fish, which they are, in fact, seen to do. Aristotle again criticizes the proponents of this theory for their lack of knowledge of the internal anatomy of fish (for how can the milt make its way to the uterus if its taken into the mouth, which leads to the stomach?), but in addition, he criticizes them for not observing the phenomena in the correct manner. He states:

[13] Another point which helps deceive these people is this. Fish of this sort take only a very short time over their copulation, with the result that many fisherman even never see it happening, for of course no fisherman ever watches this sort of thing for the sake of knowing. All the same, the copulation has been observed. (*GA* 756a30-34; trans. Peck, modified)

756a30

Συμβάλλεται δὲ

πρὸς τὴν ἀπάτην αὐτοῖς καὶ τὸ ταχὺ εἶναι τὸν συνδυασμὸν
τῶν τοιούτων ἰχθύων ὥστε πολλοὺς λανθάνειν καὶ τῶν ἀλιέων·
οὐθεὶς γὰρ αὐτῶν οὐθὲν τηρεῖ τοιοῦτον τοῦ γινῶναι χάριν, ἀλλ’

ὅμως ὠμμένος ὁ συνδυασμός ἐστίν.

The fishermen who support this notion that female fish are impregnated by swallowing milt presumably do have rather extensive experience with fish, in so far as they have observed them often and over a long period of time. And yet their failure comes in not observing in the right manner—not observing for the sake of knowing.²⁸⁹

But what does this amount to? Aristotle's point is that the fisherman do not observe the fish with the goal of determining the causes of what they see. Had they inquired into just *how* the milt swallowed by the female might affect reproduction, they would have recognized how unlikely it is, and thus would have sought an alternative explanation.

The important lesson I draw from these examples is that, for Aristotle, recognizing a putative first principle *as* a first principle requires one to embark on the project of explanation and requires one to test the explanatory power of a putative principle against the facts that are already established.

²⁸⁹ As an interesting side note, Both Aristotle and the fishermen in this example appear to have been wrong in their analyses. Aristotle notes how both the female fish are observed swallowing the male's milt, and the male fish are observed swallowing the female's eggs, and this is true. But the eggs are actually impregnated outside the female's body, when the male's milt and the female's eggs come into contact with one another in the water. The swallowing of the milt and the eggs appears to be an evolutionary adaptation to ensure that the fish follow each other closely, thus increasing the probability that the reproductive residues will come into contact.

6.4 CONCLUDING REFLECTION

Given that experience allows one to more effectively test the explanatory power of a putative first principle against a wider array of data, one might still wonder how we come to recognize successful instances of causal explanation in the first place. If we look to the biology and zoology, Aristotle famously subscribed to a form of teleological explanation for many of the features exhibited by animals. For example, with regard to their parts, it is generally the case that the presence and differentiation of a part of an animal is explained by the function it performs and how it contributes to the animal's way of life. In *HA* Aristotle claims that practically everything an animal does—all of its efforts—are aimed at two activities, feeding and reproducing. According to Aristotle, most of the unique features of an animal can be explained by inquiring after how those features contribute to an animal's ability to feed and reproduce, given certain other facts about the animal that appear to be fundamental, such as the environment in which the animal lives and the structure of its body and certain of its bodily parts. In the case of birds, Aristotle seems to hold that certain of their features are simply unique and inexplicable, such as that they are fliers or that they have beaks. But, given that they are fliers and that they have beaks, many of the features and characteristics exhibited by specific birds can be explained in this way. For example, a bird that lives in marshlands needs long legs to successfully walk through the muck, but this additionally requires a long neck to reach the water to feed, as well as a long beak. Or, given that birds of prey are carnivorous, their way of life demands that they overpower their prey, and this in turn demands that they are equipped with strong wings, sharp talons, a hooked beak, and the like.²⁹⁰

²⁹⁰ See PA IV.12 for a discussion of the relationship between a bird's *bios* and its parts.

But what led Aristotle to believe that these facts about the birds' way of life explain the features of their parts, rather than the other way around (an explanatory strategy that was most certainly on the table)²⁹¹?

If I am correct in claiming that Aristotle would say that experience observing birds with the goal of formulating explanations led to the recognition of way of life as a cause, then we can ask, what in this experience led to this conclusion? This is not an easy question to answer, but one possibility is that experience would lead one to recognize that many, diverse features of birds are correlated with relatively few facts regarding their way of life, and this is true of other animals as well. That is, *given* that this bird is a water-dwelling plant-eater, then it is the case that these many different unique features of its body and behavior make sense and reasonably contribute to its being able to feed and reproduce successfully. And while it is true that, without these features, the bird could not support the given way of life, and thus in some sense the features make the way of life possible and could be viewed as a cause of the way of life, the fact that relatively few facts about the bird's way of life can successfully explain many facts about the bird's other features must have spoken strongly to Aristotle regarding the explanatory power, and thus explanatory significance, of way of life as an essential feature.

²⁹¹ See e.g. *PA* I.1, 240a20ff., where Aristotle discusses Empedocles' view that the backbone in humans is articulated in the manner that it is *because* of the way in which the fetus is twisted in the uterus. Thus, on Empedocles' view, the movements of the body that an articulated spine allows for are caused by the circumstances surrounding the formation of the parts. As Aristotle argues in the passage from *PA* I.1, since "a human generates a human," the form of the articulated backbone was already present in the generative motions resident in the spermatoc fluid, and is ultimately explained by the role such an articulated spine (and the corresponding movements it allows) plays in the life of a fully developed human. See *PA* I.5, 645b15ff.

APPENDIX A

REFERENCES TO *HA* IN THE ARISTOTELIAN CORPUS

Below are 24 passages from the Aristotelian corpus (numbered [1]-[24]) that appear to make direct reference to *HA*. The table below indicates which of the passages include reference to *historia* alone, to *historia* and *anatome*, etc. The third column indicates the number of passages so referenced out of the total 24. Passages in parentheses do not explicitly make the indicated reference, but arguably do so implicitly.

A.1 SUMMARY

<i>historia</i> alone:	1, 4, 5, 7, 14, 15, 18, 20, 21, 22, 23, 24	12/24
<i>historia</i> and <i>anatome</i> :	2, 3, 6, 8, 9, 10, 11, 12, 13, 16, 18, 19	12/24
<i>akribeia</i> :	1, 3, 8, 13, 14, 17, 21	7/24
makes reference to		
differences:	(10), 11, 12, 23	5/24
visual vs. <i>akribeia/logos</i> :	3, 10, (19), 23	4/24
<i>not</i> about parts:	4, 7, 17, 20, (23), 24	6/24

A.2 THE REFERENCES

[1] *Resp.* 12, 476b30-477a10

It is for the same reason that the *malakia* and *malakostraka* admit water – I mean such creatures as lobsters and crabs. None of these happens to need cooling; for each of these species is of low temperature and bloodless, so that it is sufficiently cooled by the surrounding water; but they admit water in feeding, <and so must expel it> so that the water may not flow in as they are absorbing food. The *malakostraka*, such as crabs and lobsters, discharge the water through the folds by the hairy parts, but the cuttlefish and polypus through the hollow above the so-called head. I have given a more exact account of these in my History of Animals. Concerning the admission of water, then, we have explained that it occurs for the purpose of cooling, and because those creatures which naturally live in water must derive their food from the water. (trans. Hett)

476b30 διὰ ταῦτὸ δὲ τοῦτο δέχεται καὶ τὰ μα-
λάκια τὸ ὕδωρ καὶ τὰ μαλακόστρακα, λέγω δ' οἶον τοὺς
καλουμένους καράβους καὶ τοὺς καρκίνους. καταψύξεως μὲν
γὰρ αὐτῶν οὐδὲν τυγχάνει δεόμενον· ὀλιγόθερμον γάρ ἐστι
καὶ ἄναιμον ἕκαστον αὐτῶν, ὥσθ' ἱκανῶς καταψύχεται ὑπὸ
477a1 τοῦ περιέχοντος ὕγρου, ἀλλὰ διὰ τὴν τροφήν ἀφίησι τὸ ὕδωρ,
ὥπως μὴ ἅμα δεχομένοις εἰσρέημι τοῦ ὕγρον. τὰ μὲν οὖν μαλακ-

ὅστρακα, οἷον οἳ τε καρκίνοι καὶ οἱ κάραβοι, παρὰ τὰ δασέα
 ἀφιάσι τὸ ὕδωρ διὰ τῶν ἐπιπτυγμάτων, σηπία δὲ καὶ πολύ-
 a5 ποδες διὰ τοῦ κοίλου τοῦ ὑπὲρ τῆς καλουμένης κεφαλῆς. γέ-
 γραπται δὲ περὶ αὐτῶν δι' ἀκριβείας μᾶλλον **ἐν ταῖς περὶ**
τῶν ζώων ιστορίαις. περὶ μὲν οὖν τοῦ δέχεσθαι τὸ ὑγρόν,
 εἴρηται ὅτι συμβαίνει διὰ κατάψυξιν καὶ διὰ τὸ δεῖν δέχε-
 σθαι τὴν τροφήν ἐκ τοῦ ὑγροῦ τὰ τὴν φύσιν ὄντα τῶν ζώων
 a10 ἔνυδρα.

Although the reference to *HA* appears in an independent sentence that could easily be elided without losing any of the sense or flow of the argument, nothing in Ross's app crit suggests that it is a late (i.e. post-Aristotelian) addition, and its appearance at the end of the argument, immediately preceding the summarizing statement at a7, seems appropriate. Just the same, that it may easily be removed allows for the possibility that Aristotle (or an associate) added the reference himself after the treatise was completed or nearly complete.

The arrangement of the various inlets and outlets for water, flaps, etc. are challenging to visualize, due in large part to the relative unfamiliarity of the anatomy of these creatures. *HA* does contain a more detailed description of these parts. Interestingly, the *HA* discussion includes reference to the parts' functions, and thus is not totally free of such "theoretical commitments" as a purely descriptive anatomy might imply. To what extent does *HA* also provide an account of the *function* of parts? To what extent is such a functional account tied to a causal/explanatory account of the parts? What does *PA* say of these parts? (It looks like not much! See *PA* IV.5).

Does the additional or more detailed information provided by *HA* add anything to the argument presented here in *Resp.*? That is, do those details somehow bolster the argument?

The first part of the argument is based on the claim that animals like *malakia* and *malakostraka* do not need to take in and expel water for the sake of cooling, but rather the water in their environment that surrounds them provides sufficient cooling for their already rather moderate levels of vital heat. Thus there need not be any special parts of passageways for water to traverse in order to affect the cooling (e.g. trachea, lungs, gills, etc.).

What evidence is marshaled, and what is the reasoning, that leads to these conclusions? Is it that these animals clearly do not possess lungs, and, unlike fish, appear not to possess gills? If that is so, *and one assumes that there must be some means of cooling the vital heat in order to maintain survival*, then there must be some other mechanism employed to affect this cooling. In the absence of any obvious part, attributing it to the environment seems reasonable enough. And in fact, according to Ogle, many such animals actually do respire in this manner (see Ogle, p. 121, n80).

But these animals do take in water when feeding, so they need some means of expelling that water otherwise the parts that receive food would become filled with water. The parts specified expel this water during feeding (and, whether Aristotle recognized or explicitly stated it, at other times as well).

If the *HA* account of these parts makes it clear that water is expelled by them, and that these animals have no obvious organs of respiration, then it would support the argument here in *Resp.*, and the reference is appropriate and helpful. In other words, this is the sort of information one would hope to find in the *HA* reference.

In sum, Aristotle often refers to “gill-like” parts near these inlet and outlet folds in *malakostraka*, and they are indeed gills, but Aristotle does not seem to recognize them as such. His various descriptions of these parts in *HA* include a “functional” analysis that supports his general view that these animals do not need to take in water as a means of cooling their internal heat. In this sense the *HA* descriptions are “theory-laden” – they do in fact speculate on functions (and thus cause?!?).

Ogle: See n121 (pg. 127); Ross: *HA* IV.1, 524a9-12 (*koilon aulon* of the *malakia*), b21-22; IV.2, 526a26-27, b19-21, IV.3, 527b18-22; Hett: *HA* IV.1, 523a30, etc.; Morel: *HA* IV.1-3; Balme: *ad* 526b18

[2] *Resp.* 478a21-28

From this it is obvious why animals which have blood in the lungs breathe most; for the warmer creature requires more cooling, and at the same time the breath passes easily to the source of heat, which lies in the heart. How the heart communicates by passages with the lung should be studied from dissections and by reference to the History of Animals. Speaking generally, the nature of animals requires cooling owing to the fierce heat which the soul acquires in the heart. This cooling is achieved by means of breathing in the case of animals which have a lung as well as a heart . . .

478a21 καὶ διότι δὴ μάλιστα ἀναπνέουσι τὰ ἔχοντα τὸν

πνεύμονα ἔναιμον, ἐκ τούτων δῆλον· τό τε γὰρ θερμότερον
 πλείονος δεῖται τῆς καταψύξεως, ἅμα δὲ καὶ πρὸς τὴν ἀρ-
 χὴν τῆς θερμότητος τὴν ἐν τῇ καρδίᾳ πορεύεται τὸ πνεῦμα
 a25 ῥαδίως.
 Ὅν δὲ τρόπον ἡ καρδία τὴν σύντρησιν ἔχει πρὸς τὸν
 πνεύμονα, δεῖ θεωρεῖν ἔκ τε τῶν ἀνατεμνομένων καὶ τῶν
 ἱστοριῶν τῶν περὶ τὰ ζῷα γεγραμμένων. καταψύξεως μὲν
 οὖν ὅλως ἡ τῶν ζώων δεῖται φύσις διὰ τὴν ἐν τῇ καρδίᾳ τῆς
 a30 ψυχῆς ἐμπύρευσιν. ταύτην δὲ ποιεῖται διὰ τῆς ἀναπνοῆς (30)
 ὅσα μὴ μόνον ἔχουσι καρδίαν ἀλλὰ καὶ πνεύμονα τῶν ζώων.
 τὰ δὲ καρδίαν μὲν ἔχοντα, πνεύμονα δὲ μή, καθάπερ οἱ
 ἰχθύες διὰ τὸ ἔνυδρον αὐτῶν τὴν φύσιν εἶναι, τῷ ὕδατι ποι-
 οῦνται τὴν κατάψυξιν διὰ τῶν βραγχείων.

Here Aristotle is arguing that the hottest animals are the ones with much blood in the lungs. Air is ideal for cooling in these cases because it is so “rarefied” (*leptên*) and thus easily penetrates the whole lung, while water, being less so, could not (and thus Empedocles was wrong in asserting that water animals are hotter). Thus air serves to better cool the blood in the lungs, and it also easily passes to the heart (the *archê* of the natural heat) through the passages from the lungs to the heart. Aristotle references both the “dissections” and the “written histories” as what should be studied to learn more about the manner in which the heart and lungs are connected.

Seeing/learning more about the manner in which the heart and lungs are connected supports the present argument in so far as without such passages it's not clear how the respired

air could help cool the heart. That is, if one clearly grasps the connections between the heart and lungs, then one is in a position to speculate regarding the *purpose* of these connections: they provide easy passage of breath, taken in through the mouth, passed by way of the trachea to the lungs, and from there to the heart.

A likely text answering to the reference, *HA* I.17, 496a27, states that the passages connecting the lungs to the heart “convey it (i.e. breath) to the heart”. This statement seems to imply the cooling function described here in *Resp.*, and thus *HA* may here imply the causal analysis in *Resp.*

Ogle: I.17, III.2-3 (see n132-134, pg. 131); Ross: 496a27-34; Hett: 496a, etc., 511b, etc.

[3] *Resp.* 478a34-b2

The position of the heart relative to the gills should be studied visually from the dissections, and in detail by reference to the History; but to summarize for our present purpose, the facts are as follows.

478a34

ὥς δ' ἡ θέσις ἔχει

τῆς καρδίας πρὸς τὰ βράγχια, πρὸς μὲν τὴν ὄψιν ἐκ τῶν

b1

ἀνατομῶν δεῖ θεωρεῖν, πρὸς δ' ἀκρίβειαν ἐκ τῶν ἱστοριῶν· ὥς

δ' ἐν κεφαλαίοις εἰπεῖν καὶ νῦν, ἔχει τόνδε τὸν τρόπον.

This reference, dealing with the heart-gill association, is coordinate with that in [2], which deals with the heart-lung association.

Ogle: (1) I.17, III.2-3; (2) II.17, 507b3 (see n132-134, pg. 131); Ross: (1) 496a27-34; (2) 507a2-10; Hett: (1) 496a, etc., 511b, etc.; (2) 507b3

[4] IA 704b8-11

Regarding all these things, and as many others as are similar to these, we must investigate the causes. That these things hold in this way is clear from the natural *historia*, but why they do, must now be examined.

704b8 περὶ δὴ πάντων τούτων, καὶ ὅσα ἄλλα συγγενῇ τούτοις,
τὰς αἰτίας θεωρητέον. ὅτι μὲν οὖν οὕτω ταῦτα συμ-
b10 βαίνει, **δῆλον ἐκ τῆς ἱστορίας τῆς φυσικῆς**, διότι δέ, νῦν
σκεπτέον.

The facts referred to in this passage all pertain, as the entire treatise does, to aspects of animal locomotion, and include such facts as *all blooded animals move at four points, all bloodless animals move at more than four points, all animals with feet have an even number of feet, humans and birds are the only two-footed animals but bend their legs oppositely*, etc. In this passage, the connection with *hoti* and *dioti* forms of enquiry is perhaps even stronger, in so far as these terms are actually used in the appropriate sense in the passage itself. It is of note that the

language used in this passage – *tês historiais tês phusikês* – is similarly ambiguous to that found in [1].

[5] *PA* II.1, 646a9, 11

From which parts and from how many parts each of the animals is constituted has been exhibited more clearly in the enquiries about them; it is the causes owing to which each animal has this character that must now be examined, on their own and apart from what was said in those enquiries.

646a8 Ἐκ τίνων μὲν οὖν μορίων καὶ πόσων συνέστηκεν ἕκαστον
τῶν ζώων, ἐν ταῖς ἱστορίαις ταῖς περὶ αὐτῶν δεδήλωται σα-
a10 φέστερον· δι’ ἧς δ’ αἰτίας ἕκαστον τοῦτον ἔχει τὸν τρόπον,
ἐπισκεπτέον νῦν, χωρίσαντας καθ’ αὐτὰ τῶν ἐν ταῖς ἱστορίαις
εἰρημένων.

In this passage Aristotle appears to distinguish two stages of investigation: a preliminary stage dedicated to establishing certain facts regarding the parts exhibited by animals, and a later stage dedicated to determining the causes that explain why each animal possess the parts that it does, and why the parts have the character that they do. This distinction appears to be the same one made in the important methodological passage in *HA* I.1, and it corresponds reasonably well to the distinction between the *hoti* and *dioti* enquiries discussed in *APo.* II.1.

What does Aristotle mean when he states that the causes should be discussed “on their

own and apart from what was said in those enquiries”? How separate can an account of the causes be from the details of the shape, disposition, etc. of the parts? Does the *HA* discuss the various parts of animals in a manner that is more clear than what is found in *PA*? That is, can we say with any confidence that the reference in [2] is to the *HA* as we have it today?

[6] *PA* II.3, 650a32.

For the blood vessels extend all through the intestines, beginning beneath the stomach and extending up to it. These things should be studied with the help of the dissections and natural enquiries.

650a29

αἱ γὰρ φλέβες κατατείνονται

διὰ τοῦ μεσεντερίου παράπαν, κάτωθεν ἀρξάμεναι μέχρι τῆς
κοιλίας. Δεῖ δὲ ταῦτα θεωρεῖν **ἐκ τε τῶν ἀνατομῶν καὶ τῆς
φυσικῆς ἱστορίας.**

Context: There must be *poroi/archai* (see textual note 1, Peck pg. 134) through which digested nutriment can pass from the stomach and intestines to the rest of the body, just as the roots of plants take nutriment from the earth. What additional information could the *historia* provide? Additional details regarding where the blood vessels attach and where they extend to, and how this varies in different animals. The number of blood vessels that extend from the stomach/intestines could be specified.

What information can the dissections provide that the *historia* cannot, or cannot do as

well? If the dissections include or are pictures, then one could see that the blood vessels look like roots, thus reinforcing the analogy between them. That is, the *structural similarities* of roots and blood vessels point to a *functional similarity*.

To what extent does this explanation *assume* the theory of blood as final stage of nutriment? To what extent does it *support* it? That is, if one assumes that the blood is a form of concocted nutriment that is used to nourish the rest of the body, then there would be a need for vessels to carry this nourishment from the stomach and intestines (where food is digested) to the rest of the body.

Louis: *HA* III.4, 514b12; Peck: *HA* I.16, 495b19ff (really 32ff); III.4, 514b10ff

[7] *PA* II.17, 660b2.

And though all (birds) also use their tongue to communicate with one another, some do so more than others, so that in some cases they even seem to be learning from one another; these things have been discussed in the enquiries about animals.

660a35

Καὶ χρῶνται τῇ γλώττῃ καὶ πρὸς ἔρμη-

νεῖαν ἀλλήλοισι πάντες μὲν, ἕτεροι δὲ τῶν ἐτέρων μᾶλλον,

b1

ὥστ' ἐπ' ἐνίων καὶ μάθησιν εἶναι δοκεῖν παρ' ἀλλήλων· εἴρη-

ται δὲ περὶ αὐτῶν ἐν ταῖς ἱστορίαις ταῖς περὶ τῶν ζώων.

The discussion here is not just about *birds*’ tongues and vocalization, but rather about the relationship between the tongue and vocalization generally. At *HA* IV.9, 536b14ff there is a brief discussion of birds learning and teaching song to offspring. Presumably the reference is meant to provide additional *particular* examples of vocalization in birds to support the generalized conclusions made here.

Peck: 504b1, 536a20ff, 597b26, 608a17; Louis: *HA* IV.9, especially 536a20-b23

[8] *PA* III.5, 668b30.

But to know with accuracy how the blood vessels are situated relative to one another, one should base one’s study on the dissections and the zoological enquiry. We may take it that the blood vessels and heart have been discussed; we need to examine the other viscera according to the same procedure.

668b28

Τὸ δὲ μετ’ ἀκριβείας ὥς ἔχουσιν

αἱ φλέβες πρὸς ἀλλήλας, ἔκ τε τῶν ἀνατομῶν δεῖ θεωρεῖν

b30

καὶ ἐκ τῆς ζῳικῆς ἱστορίας. Καὶ περὶ μὲν φλεβῶν καὶ

καρδίας εἰρήσθω, περὶ δὲ τῶν ἄλλων σπλάγχνων σκεπτέον

κατὰ τὴν αὐτὴν μέθοδον.

The immediate context is a discussion of the manner by which the major blood vessels cross each other as they extend through the body, front to back and back to front, and in this way

function to hold the body together, just as plaiting or twining is used to hold material together. The reference to the *historia* and *dissections* could supplement the argument if additional information regarding the manner in which such vessels cross over one another is there provided. Additionally, if the dissections included pictures of such crossing vessels, and if these pictures did in fact resemble the plaiting or twining of materials, then this could strengthen the argument.

The final comment (*kai peri men . . .*) concludes not just this immediate discussion, but the entire discussion of the heart and vessels, which began at *PA* III.4.

[9] *PA* III.14, 674b16.

The study of the way in which these parts are related to one another in position and in their form should be based on the enquiry about animals and the dissections.

674b15 Ὅν δ' ἔχει τρόπον ταῦτα πρὸς ἄλληλα τῇ
θέσει καὶ τοῖς εἶδεσιν, ἔκ τε τῆς ἱστορίας τῆς περὶ τὰ ζῷα
δεῖ θεωρεῖν, καὶ ἐκ τῶν ἀνατομῶν.

The context is a discussion of animals that have multiple stomachs, and the service they perform for these animals. Additional information on the relative positions and forms of these parts would not necessarily support the argument regarding their function (especially the point regarding the relationship between dentation and digestion), but may serve to demonstrate more clearly the manner in which they all look like stomachs, and all receive concocted nourishment

one from the next. If the dissections include pictures, then such pictures may communicate more clearly the positions and shapes of these parts than a written *historia*

Peck: *HA* II.17, 507a36ff; Louis: same

[10] *PA* IV.5, 680a1.

All these, and the other hard-shelled animals, as was said, have a mouth, a tongue-like part, a stomach, and a residual outlet, though each part differs in position and size. (The manner in which each of them has these parts should be studied with the help of the enquiries about animals and of the dissections. For some of these things need to be clarified by an account, others rather by visual inspection.)

679b34

Πάντα μὲν οὖν

ἔχει, καθάπερ εἴρηται, καὶ τᾶλλα τὰ ὀστρακόδερμα στόμα
τε καὶ τὸ γλωττοειδὲς καὶ τὴν κοιλίαν καὶ τοῦ περιττώματος
τὴν ἔξοδον, διαφέρει δὲ τῇ θέσει καὶ τοῖς μεγέθεσιν. Ὅν δὲ

680a1

τρόπον ἔχει τούτων ἕκαστον, **ἐκ τε τῶν ἱστοριῶν τῶν**
περὶ τὰ ζῷα θεωρεῖσθω καὶ ἐκ τῶν ἀνατομῶν· τὰ μὲν γὰρ τῷ
λόγῳ τὰ δὲ πρὸς τὴν ὄψιν αὐτῶν σαφηνίζειν δεῖ μᾶλλον.

The context of this passage is a discussion of the parts of bloodless animals, specifically the *malakia*, *malakostraka*, and *ostrakoderma*. This passage is rather unique in so far as Aristotle

points to different reasons why one might study the *anatomai* as opposed to the *historiai*. Specifically, the *anatomai* are studied *pros tēn opsin* while the *historiai* provide a *logos*. Lennox rightly points out that, while it is natural to read these references to *anatomai* as to pictures of some sort, they may just as well be to actual dissections (Lennox 299). One can imagine that in some cases simply looking at a part (or two parts in different animals) will reveal its identity, function, etc., while in other cases inspection alone may not provide the necessary information.

But what must be determined in the *historiai* stage in order to provide this information? That is, how is “the manner in which each of them has these parts” determined? How do we recognize a part as *this* part?

Peck: *HA* 528b10; Louis: *HA* IV.4

[11] *PA* IV.8, 684b5.

Each of the parts – what their positions are and what differences there are from one animal to another, including in what way the males differ from the females – should be studied with the help of the dissections and the enquiries about animals.

684b2

Καθ’

ἕκαστον δὲ τῶν μορίων, τίς ἡ θέσις αὐτῶν καὶ τίνες διαφο-
ραι πρὸς ἄλληλα, τῶν τ’ ἄλλων καὶ τίνι διαφέρει τὰ ἄρρενα

b5

τῶν θηλειῶν, ἕκ τε τῶν ἀνατομῶν θεωρεῖσθω καὶ ἐκ τῶν ἱστο-
ριῶν τῶν περὶ τὰ ζῷα.

“The parts” referred to here are primarily locomotive parts, such as feet, claws, tail, etc. The immediate discussion is of the differences of such parts in different kinds of *malakostraka*. However this passage marks the beginning of a transition to a discussion of the internal parts of these animals, so the antecedent of “these parts” may be the external parts generally, rather than the locomotive parts.

The references to “position” (*thesis*) and especially differences (*diaphorai*) provide an especially nice connection to *HA*, as these are topics that are especially relevant there.

Lennox: *HA* IV.2, 525a30-527a35; Peck: same, plus 541b19ff; Louis: same, same

[12] *PA* IV.10, 689a18.

Both how the parts concerned with the seed and embryo are arranged internally and in what manner they differ are apparent with the help of the enquiry about animals and the dissections, and will be stated later in the works on generation.

689a17 Ἐντὸς δὲ πῶς ἔχει, καὶ πῇ διαφέρουσι τὰ
τε περὶ τὸ σπέρμα καὶ τὰ περὶ τὴν κύησιν, **ἐκ τε τῆς ἱστορίας**
τῆς περὶ τὰ ζῷα φανερόν καὶ τῶν ἀνατομῶν, καὶ ὕστερον
a20 λεχθήσεται ἐν τοῖς περὶ γενέσεως.

This reference is of particular interest because the corresponding passage in *HA*, in III.1,

includes a reference to a lettered diagram. What then do the *anatomai* include that the *historiai* do not? Again reference is here made to the way these parts differ from one another, which corresponds well with the purposes of the *HA*.

Lennox: *HA* III.1, 510a29-35; Louis: *HA* I.13, 14 (493a25ff), 17 (497a27); *GA* I.2-16; Peck: same

[13] *PA* IV.13, 696b15.

Some fish have many gills, some few, and some have double gills, some simple ones; in most of them, however, the last one is simple. (For accuracy, one should study with the help of the dissections of these things and the enquiries about animals.)

696b12

Οἱ μὲν οὖν αὐτῶν

ἔχουσι πολλὰ βράγχια οἱ δ' ὀλίγα, καὶ οἱ μὲν διπλᾶ οἱ δ' ἀπλᾶ·

τὸ δ' ἔσχατον ἀπλοῦν οἱ πλεῖστοι. Τὴν δ' ἀκρίβειαν ἐκ τῶν

b15

ἀνατομῶν περὶ τούτων καὶ ἐν ταῖς ἱστορίαις ταῖς περὶ τὰ

ζῷα δεῖ θεωρεῖν.

As Lennox points out (pg. 340), the reference to the dissections here is slightly different (“the dissections *of these things*”), and the suggestion may be to study the actual dissections, and not a written or pictorial account of them.

Peck: *HA* 504b28ff; Lennox: *HA* II.15, 505b8-18; Louis: *HA* II.13, 504b28, 505a20

[14] *GA* I.3, 716b31

I have given a more accurate account of these in the *historia* about animals.

716b30

διώρι-

σται δὲ περὶ αὐτῶν ἀκριβέστερον ἐν ταῖς ἱστορίαις ταῖς περὶ
τῶν ζώων.

The discussion here is about the testicles and their presence, position, etc. in different kinds of animals. As noted by Peck, *HA* III.1 seems to answer the reference.

[15] *GA* I.4, 717a31-34

In the vivipara, as for instance in horses and other such animals, and also in man, they [the testicles] do this by maintaining in position the doubling-back of the passages (for a description of this reference must be made to the *Researches upon Animals*), since the testes are no integral part of the passages . . .

717a31

ἐν μὲν τοῖς ζωοτόκοις οἷον ἵπποις

τε καὶ τοῖς ἄλλοις τοῖς τοιούτοις καὶ ἐν ἀνθρώποις σώζοντες

τὴν ἐπαναδίπλωσιν (ὃν δὲ τρόπον ἔχει αὕτη ἐκ τῶν ιστο-
ριῶν τῶν περὶ τὰ ζῷα δεῖ θεωρεῖν).

Peck: HA 510a20ff., GA 718a15

[16] GA II.11, 719a8-10

However, to ascertain the arrangement of the uterus of the selachians and other
kinds as well, the Dissections should be inspected and also the Researches.

718a8

δεῖ

δὲ καὶ περὶ ταύτης καὶ περὶ τῶν ἄλλων ὕστερων, ὃν τρόπον
a10 ἔχουσιν, ἔκ τε τῶν ἀνατομῶν τεθεωρηκέναι καὶ τῶν ιστοριῶν.

Peck: 510b5ff

[17] GA 728b14

An exact account of this matter, as it concerns every sort of animal, is to be found
in the *historia* about animals.

728b12

δι' ἀκριβείας δέ, πῶς συμβαίνει

ταῦτα περὶ ἕκαστον τῶν ζώων, γέγραπται ἐν ταῖς περὶ τὰ

ζῶα ἱστορίαις.

The discussion is about menstruation in female animals. Peck notes *HA* VI.18, 572b29ff.

[18] *GA* 740a19-23

. . . for an animal, the ultimate for of nourishment is blood or its counterpart. Of these fluids the blood vessels are the receptacle, and therefore the heart is the first principle of them as well. This is clearly brought out in the *Researches* and in the *Dissections*.

740a19

τροφή δὲ ζώου ἢ ἐσχάτη αἷμα καὶ
τὸ ἀνάλογον, τούτων δ' ἀγγεῖον αἱ φλέβες· διὸ ἡ καρδία
καὶ τούτων ἀρχή· δῆλον δὲ τοῦτο ἐκ τῶν ἱστοριῶν καὶ τῶν
ἀνατομῶν.

Peck: *HA* III.3

[19] *GA* II.7, 746a15

All this should be studied with the help of the illustrative diagrams given in the *anatomai* and in the writings in the *historiai*

also for an account of the membranes and umbilical cords, what is written *en tais historiais* should be studied; for our present inquiry it is sufficient that thus much should be clear, viz., that once the heart has been formed (this comes first of all) and the Great Blood-vessel has been marked off from it, two umbilical cords extend from this blood vessel

753b14

δι' ἀκριβείας μὲν οὖν, ὃν τρόπον ἔχουσι
ταῦτα πρὸς ἄλληλα κατ' ἀρχάς τε τῆς γενέσεως καὶ συν-
ισταμένων τῶν ζώων, ἔτι δὲ περὶ τε ὑμένων καὶ περὶ ὀμφαλῶν ἐκ
τῶν ἐκ ταῖς ἱστορίαις γεγραμμένων δεῖ θεωρεῖν·

The discussion is of the development of the embryo in an egg. Peck refers us to *HA* VI.3, 561a3-562b2, but notes “the description there is no fuller.”

[22] *GA* III.8, 758a23-25

For a figure showing the way in which it is situated during the process of formation, the Researches should be consulted

758a23

τὸ δὲ
σχῆμα τῆς θέσεως ὃν ἔχει γιγνόμενα τρόπον δεῖ θεωρεῖν
ἐκ τῶν ἱστοριῶν.

Peck: HA 550a10ff.

[23] GA III.10, 761a10

To find out the various differences between each of these kinds of creatures, and between them and bees, the records given *peri tas historias* should be studied.

761a8

πόσας

δ' ἔχουσι διαφορὰς ἢ πρὸς ἄλληλα τῶν τοιούτων γενῶν ἕκα-
στον ἢ πρὸς τὰς μελίττας ἐκ τῶν περὶ τὰς ἱστορίας ἀναγε-
γραμμένων δεῖ θεωρεῖν.

The discussion is of the generation of hornets and wasps, and how it differs from that of bees. Peck cites *HA* VIII(IX).41, 627b23ff; VIII(IX).42, 628b32ff.

[24] GA III.11, 763b16

For an account dealing with these individually, and the places where they grow, the student should consult *ek tês historias*.

763b15

τὰ δὲ καθ' ἕκαστα περὶ τούτων καὶ ἐν οἷς γίνονται τόποις
ἐκ τῆς ἱστορίας θεωρεῖσθω.

The discussion is of the spontaneous generation of the *ostrakoderma*. Peck provides no reference to *HA*.

APPENDIX B

***POSTERIOR ANALYTICS* II.17, 99A30-B7: THE “SCHEMATIC” PASSAGE**

APo. II.17, 99a30-b7 (the “schematic” passage) is a challenging passage which commentators have found difficult to interpret and fit into the general argumentative context of II.16-18. II.17 considers the relationship between a cause and its effect, specifically whether the same effect always has the same cause. Ross offers a rather contrived reading of the text, which, though consistent, seems unlikely. Barnes suspects that “there is no reconciliation” of the passage with its immediate argumentative context, and Charles suggests emendations to the text to help make sense of his reading.

B.1 THE ARGUMENT OF *POSTERIOR ANALYTICS* II.16-18

APo. II.16 raises the question of whether cause (*aitia*) and effect (*ou aition*) are coextensive, such that the presence of a cause implies the effect, and the presence of the effect implies the cause. The chapter proceeds, apparently aporetically, by suggesting, first, that if cause and effect are coextensive, then deductions may be constructed with either cause or effect as the middle term, such that one may “prove” the effect through the cause, or the cause through

the effect. Aristotle points out that things cannot be mutually explanatory, such that the demonstration of the cause through the effect would not give the reason why (*dioti*) the cause holds, but rather only the fact that (*hoti*) it holds. Extension, for Aristotle, does not indicate causal priority.

II.16 next asks whether the same effect may have more than one cause, such that the presence of the cause would imply the effect, but the presence of the effect would not imply a specific cause, only *some* cause. This suggestion is not explicitly endorsed or rejected.

Finally, the chapter ends with the suggestion that cause and effect are coextensive, when considered from the correct level of generality. The example of leaf-shedding is offered as an illustration: many different forms of plant may shed their leaves, however all together the leaf-shedders form a single kind to which leaf-shedding belongs primitively (i.e. the kind is coextensive with leaf shedding). The cause of the shedding of leaves (e.g. coagulation of sap) is always present to this kind when leaves are shed. Again, this alternative is not explicitly endorsed or rejected.

II.17 raises the question anew, and is typically interpreted as Aristotle's "positive" response to the problem of the relation of cause and effect treated aporetically in II.16. The chapter begins by asking whether the same effect may have different causes in different things. Aristotle first allows that the cause may be different in different things if the demonstration revealing the cause proceeds either incidentally or "in virtue of a sign." But in these cases the so-called "cause" so identified is not the true cause, and it is thus only in a manner of speaking that an effect can have more than one cause.

He then proceeds to elaborate on the leaf shedding example introduced in II.16, indicating that this example does illustrate his views on the relation between cause and effect. In

this discussion he makes it clear that an attribute may extend further than a given subject, but when grouped together all the subjects that exhibit the attribute will form a single kind to which the attribute belongs primitively, and to this kind a single cause will apply that explains the presence of the attribute. Thus we have:

Vine

Fig → Broad-Leafed ↔ Sap congeals ↔ Leaf-Shedding

Etc.

The problem “why do vines shed their leaves?” is solved first by locating vines into the more general kind (i.e. broad-leafed) to which the feature “leaf-shedding” belongs primitively. Then a cause is (somehow) found that is responsible for the shedding of leaves in this kind. In this case, two middle terms are used to connect “vine” with “leaf shedding,” and so in one sense there is more than one cause of leaf-shedding in vines, but in another there is only one cause (i.e. sap congealing) that applies to the kind that possesses the attribute primitively.

The schematic passage, which apparently is meant to illustrate this very point, follows and ends the chapter.

II.18 then takes up the question of which of the middle terms connecting a subject with an attribute is best considered the cause of the attribute, the one closest to the subject of attribute (or, if more than two, some one in between)?

The argumentative flow of these chapters thus begins with Aristotle considering the relationship between cause and effect, specifically whether the same effect can have more than one cause, proceeds aporetically by offering possible solutions, and concludes by offering

Aristotle's own preferred solution.

The problem, recognized by many commentators, is that the schematic passage appears to conflict with the solution Aristotle offers in the first part of II.17. Appendix subsection.

B.2 THE "SCHEMATIC" PASSAGE

Here is Ross's text of the schematic passage, followed by a translation.

99a30 (1) Ἐπὶ δὲ τῶν σχημάτων ὧδε ἀποδώσει ζητοῦσι τὴν παρ-
ακολουθήσιν τοῦ αἰτίου καὶ οὗ αἴτιον. (2) ἔστω τὸ A τῷ B ὑπάρ-
χειν παντί, τὸ δὲ B ἐκάστῳ τῶν Δ, ἐπὶ πλεον δέ. (3) τὸ μὲν
δὴ B καθόλου ἂν εἴη τοῖς Δ· τοῦτο γὰρ λέγω καθόλου ὅ
μὴ ἀντιστρέφει, πρῶτον δὲ καθόλου ὅ ἕκαστον μὲν μὴ ἀντι-
a35 στρέφει, ἅπαντα δὲ ἀντιστρέφει καὶ παρεκτείνει. (4) τοῖς δὴ
Δ αἴτιον τοῦ A τὸ B. δεῖ ἄρα τὸ A ἐπὶ πλεον τοῦ B ἐπεκ-
τείνειν· εἰ δὲ μή, τί μᾶλλον αἴτιον ἔσται τοῦτο ἐκείνου; (5) εἰ
δὴ πᾶσιν ὑπάρχει τοῖς E τὸ A, ἔσται τι ἐκεῖνα ἐν ἅπαντα
ἄλλο τοῦ B. εἰ γὰρ μή, πῶς ἔσται εἰπεῖν ὅτι ὅ τὸ E, τὸ
99b1 A παντί, ὅ δὲ τὸ A, οὐ παντὶ τὸ E; διὰ τί γὰρ οὐκ ἔσται
τι αἴτιον οἷον [τὸ A] ὑπάρχει πᾶσι τοῖς Δ; (6) ἀλλ' ἄρα καὶ
τὰ E ἔσται τι ἐν; ἐπισκέψασθαι δεῖ τοῦτο, καὶ ἔστω τὸ Γ.
(7) ἐνδέχεται δὴ τοῦ αὐτοῦ πλείω αἴτια εἶναι, ἀλλ' οὐ τοῖς αὐ-
b5 τοῖς τῷ εἶδει, οἷον τοῦ μακρόβια εἶναι τὰ μὲν τετράποδα

τὸ μὴ ἔχειν χολήν, τὰ δὲ πτηνὰ τὸ ξηρὰ εἶναι ἢ ἕτερόν

τι.

It shall be exhibited/shown in the case of the figures (by the figures) in this way, if/when you are seeking the interrelation of cause and that which is caused. Let A belong to all B, and B to each of the Ds, but also to more. B would then be universal to the Ds. For I call that universal which does not convert, but the primitive universal is that which does not convert with each, but does convert with all together and coextends. Then for the Ds, B is the cause of A. Therefore it is necessary that A extend to more than B; if not, why will this be the cause rather than that? If then A belongs to all the Es, all of these will be some one thing other than B. For if not, how will it be said that that to which E belongs, A belongs to all, but that to which A belongs, E does not belong to all. For why will there not be some cause such as belongs to all the Ds? But indeed will the Es be some one thing? It is necessary to investigate this, and let it be C. Then it is possible that many things are the cause of the same thing, but not for things the same in form, for example, [the cause] of long-life with respect to quadrupeds is not having bile, but for birds is the dry or something else.

B.3 TRANSLATION AND COMMENTARY

- (1) Ἐπὶ δὲ τῶν σχημάτων ὧδε ἀποδώσει ζητοῦσι τὴν παρακολούθησιν τοῦ αἰτίου καὶ οὗ αἵτιον.

It shall be exhibited/shown in the case of the figures (by the figures) in this way, if/when you are seeking the interrelation of cause and that which is caused.

The participial phrase beginning with *zêtousi* indicates that it is the “interrelation of cause and that which is caused” that will be made clear by the schematic example. The preceding passage in II.17 (that culminates in the leaf-shedding example) begins as follows:

The interrelation between cause, that which is caused, and that for which the cause is, holds in the following manner.

99a16

Ἔχει δ' οὕτω τὸ
παρακολουθεῖν τὸ αἷτιον ἀλλήλοις καὶ οὗ αἷτιον καὶ ὃ αἷ-
τιον·

The verbal similarities between these passages suggest that the schematic example is meant to illustrate the same interrelation as is discussed in the leaf-shedding example. In other words, the same interrelation between cause and effect discussed in the leaf-shedding example is now to be illustrated “in the case of the figures,” which here seems to mean syllogistically with letters. It is possible that the schematic example is meant to illustrate a different interrelation, but

indication of this is given, and thus it seems more probable that it is meant to be the same. As mentioned above, this is difficult since most commentators read the schematic passage as offering a *different* relationship between cause and effect than is discussed in the leaf-shedding example.

(2) ἔστω τὸ Α τῷ Β ὑπάρχειν παντί, τὸ δὲ Β ἐκάστῳ τῶν Δ, ἐπὶ πλεον δέ.

Let A belong to all B, and B to each of the Ds, but also to more (i.e. extend further)

The phrase *hekastô tôn D* indicates that there is more than one D, and that B belongs to each of them. Most commentators take this to mean that D is a kind with many different forms, and that B holds of each of these forms. But does the *epi pleon de* indicate that B extends further than all the Ds taken together, or simply further than each individual D, but not further than the kind?

In the preceding passage (99a18-20) Aristotle writes that an effect (i.e. that which is caused, *to ou aition*), extends further (*epi pleon*) relative to each subject taken individually (*kath'hekaston*), but extends equally (*ep' ison*) with the subjects taken altogether. The example he gives, first, is the attribute “having exterior angles equal to four right angles” extends further than triangle and quadrilateral (etc.), but equally with all such subjects taken together. Next he gives the example of leaf-shedding extending further than vine and fig, but extending equally with all such together. (Note though that in this example he uses *huperechei* for “extending

further” rather than *epi pleon*). In these examples an attribute is said to extend further than certain individual subjects, but not further than all of them taken together.

I think the grammar of (2) allows for reading either that B extends further than D (e.g. to E), or that B extends further than each D (but not beyond the Ds taken together). But the preceding examples suggest that we should interpret the passage as stating that B extends further than each individual D, but equally with all the Ds taken together.

- (3) τὸ μὲν δὴ Β καθόλου ἂν εἴη τοῖς Δ· τοῦτο γὰρ λέγω καθόλου ὃ μὴ ἀντιστρέφει, πρῶτον δὲ καθόλου ὃ ἕκαστον μὲν μὴ ἀντιστρέφει, ἅπαντα δὲ ἀντιστρέφει καὶ παρεκτείνει.

B would then be universal to the Ds. For I call that universal which does not convert, but the primitive universal is that which does not convert with each, but does convert with all together and coextends.

This passage states that B is universal “to the Ds.” Does this mean that B is universal to each individual D, or to all the Ds taken together (i.e. the kind D)?

If we interpret passage (2) as stating that B extends further than each individual D, but equally with all the Ds taken together, then we should read (3) as stating that B is universal to each individual D. Since, on that reading, B extends further than an individual D, B therefore does not convert with an individual D, and this is the sense in which Aristotle specifies he is using the term “universal”.

The most natural reading has it that B is universal to each D (i.e. each D implies B), but is

not a first universal to any individual D (i.e. B does not imply any individual D). The question is whether B is a first universal of the kind D (i.e. B implies some D), or whether B extends further than the kind.

- (4) τοῖς δὴ Δ αἴτιον τοῦ Α τὸ Β. δεῖ ἄρα τὸ Α ἐπὶ πλεον τοῦ Β ἐπεκτείνειν· εἰ δὲ μή, τί μᾶλλον αἴτιον ἔσται τοῦτο ἐκείνου;

Then for the Ds, B is the cause of A. Therefore it is necessary that A extend further (i.e. to more) than B; if not, why will this be the cause rather than that (or “this be the cause of that”)?

Since A holds of all B, and B holds of each of the Ds, a syllogism may be constructed connecting A with any individual D, using B as the middle term.

Is Aristotle *concluding* that B is the cause of A for each D, or *asserting* it? Passage (2) implies that A belongs to each D, but does not necessarily imply that B is the true cause of A belonging to D (understanding *aition* in the strict sense spelled out in *APo.* I).

Ross emends his text to read *epekteinein* while all the MSS read *parekteinein*. He reasons that *parekteinein* in a35 just above (see passage (3)) means “are coextensive,” and that cannot be the meaning here. In fact, as Ross reads the passage, Aristotle’s point is that A and B must *not* be coextensive (as the *epi pleon* indicates).

But *why* must A extend further than B? How is this a necessary inference from B being the cause of A in D, as the *dei ara* indicates?

According to Ross, A must extend further than B because if it did not (i.e. if they were equal in extension) then either could act as a middle term to demonstrate the other. He reads the second clause as asking “why will *this* (i.e. A) be the cause rather than *that* (i.e. B).” While it is true that if they were coextensive either could serve as a middle term, Aristotle has already addressed this issue in II.16, making the distinction between demonstrating the fact and the reason why. Why bring it up again here? Perhaps because it was discussed aporetically in II.16, and its application here is affirmative? But that doesn’t make sense, since Aristotle clearly holds that cause and effect may be coextensive while maintaining a causal priority of one term over the other. Specifically here, just because A and B are coextensive does NOT mean that we have no reason of preferring one over the other as cause (Barnes raises this very point, p. 256). Thus B being the cause of A in D does not imply that A must extend further than B.

Charles reads the *dê* as *de* (or *de dê*), and takes (4) as introducing a new case. As he writes:

This case is problematic (let us suppose) because A extends further than B. (If this were not so, B would not be the cause of D’s being A but of some wider group (e.g. D’s and E’s) being A. (p. 211)

As is reflected in this quote, Charles reads the final question of (4) as asking “why is this (i.e. B) rather the cause of the that (i.e. AaD)” (see pg. 211, n24). In other words, if A was equal in extension with B, and extended further than D, then why would B be the cause of A in D, rather than the cause of A in some larger group that includes D.

It seems Charles reads the *dei ara* as indicating that A must extend further than D

because the case illustrated is meant to be problematic, namely a case where that which is caused (i.e. the effect) has different causes in different things (B for the Ds and, as we shall see, C for the Es).

Reading the *touto ekeinou* as “this of that” instead of “this [rather] than that” has the virtue of absolving Aristotle of making the seemingly errant point that coextension would imply bi-causality, but it must be admitted that the Greek text *looks* as though it reads “this [rather] than that.”

Is there any way to interpret the *dei ara* where the necessity of A extending further than B really does flow from the fact that B is the cause of A in the Ds? The translation given is perhaps the most natural reading of the Greek, but could we instead read:

Therefore it is necessary that A extend further WITH B.

On this reading, A must extend further “with” B, i.e. extend further than D. We could justify the content of this reading if we interpret (2) as stating that B extends further than the kind D, i.e. to things other than D. In that case, A would also extend further than D, since B extends further, and B causes A,

We might then read the second clause as:

If not, why will this (i.e. B) be the cause of that (i.e. A in D)?

In other words, why would B be the cause of A, if B extends further but A does not? This reading supports the notion that the presence of a cause always implies the presence of the effect.

In short, it states that if B is the cause of A, then every instance of B implies A. Thus if B extends further than D, then A extends further than D also.

- (5) εἰ δὴ πᾶσιν ὑπάρχει τοῖς E τὸ A, ἔσται τι ἐκεῖνα ἐν ᾧ πάντα ἄλλο τοῦ B. εἰ γὰρ μή, πῶς ἔσται εἰπεῖν ὅτι ᾧ τὸ E, τὸ A παντί, ᾧ δὲ τὸ A, οὐ παντὶ τὸ E; διὰ τί γὰρ οὐκ ἔσται τι αἴτιον οἷον [τὸ A] ὑπάρχει πᾶσι τοῖς Δ;

If then A belongs to all the Es, all of these will be some one thing other than B. For if not, how will it be said that that to which E belongs, A belongs to all, but that to which A belongs, E does not belong to all. For why will there not be some cause such as belongs to all the Ds?

Similar to the reference to “each of the Ds” in (2), the plural *tois* E here suggests that Aristotle is positing that A belongs additionally to each of a number of Es, where E is some kind, and each E is a form of the kind.

What does Aristotle mean when he states that “all of these” (i.e. all the Es) will be “some one thing other than B”? One possibility is that there must be some middle term other than B connecting A and E. But is this a reasonable reading of the passage? Is it plausible that by “all of these together (i.e. the Es) will be some one thing other than B” Aristotle means that there will be some cause of A in E other than B? Are we to understand that all of the Ds taken together form some one thing that is the same as B?

The concern here seems to be that if all the Es together did not form some one thing other than B, then one would not be able to assert:

AaE

And

$\sim(EaA)$

Must we be able to assert this? Yes, on the supposition that AaE (given in passage (6)), and AaD (concluded in passage (4)). In other words, if A belongs to all E and all D, then E does not belong to everything A belongs to, because E does not belong to D (as far as we know).

If we take the preceding passage as stating that there must be some term other than B connecting A with E, then perhaps Aristotle is stating that if B did connect A with E (just as it connects A with D), then E would belong to everything A does, through the term B:

AaB	AaB
<u>BaD</u>	<u>BaE</u>
AaD	AaE

In that case we would conclude that B must connect A with E, just as it connects A with D. But then we would have EaA

The question apparently asks why will there not be some cause of A in the Es, just as there was a cause of A in the Ds. If that is the correct reading, then it implies that B is in fact not the cause of A in E.

Although there is good evidence for the *to A* in the MSS, Ross brackets the *to A* in his text, and past editors appear to have offered other emendations. It does not seem especially

problematic to me, if we can translate as follows:

For why will there not be some cause, as in the case of A belonging to all the Ds?

The bracketed *to A* is an emendation according to Ross.

(6) ἀλλ' ἄρα καὶ τὰ Ε ἔσται τι ἓν; ἐπισκέψασθαι δεῖ τοῦτο, καὶ ἔστω τὸ Γ.

But indeed will the Es be some one thing? It is necessary to investigate this, and let it be C.

Again it is unclear what Aristotle means by asking whether the Es will be one thing. Is it that each individual E was identified by its possession of A, such that Aristotle is now further asking whether the group so collected does indeed form a unified kind?

(7) ἐνδέχεται δὴ τοῦ αὐτοῦ πλείω αἷτια εἶναι, ἀλλ' οὐ τοῖς αὐ-
τοῖς τῷ εἶδει, οἷον τοῦ μακρόβια εἶναι τὰ μὲν τετράποδα (5)
τὸ μὴ ἔχειν χολήν, τὰ δὲ πτηνὰ τὸ ξηρὰ εἶναι ἢ ἕτερόν
τι.

Then it is possible that many things are the cause of the same thing, but not for things the same in form, for example, [the cause] of long-life with respect to quadrupeds is not having bile, but for birds is the dry or something else.

The passage begins by stating that it is possible for the same thing to have many causes, but not for things similar by form.

This conclusion could be construed as problematic, in so far as Aristotle has indicated throughout this section of *APo.* II that we should look to the extension of an attribute in order to guide causal research. In the leaf-shedding example, all of the plants that shed their leaves (vines, figs, etc.) were grouped together (in this case, labeled “broad-leafed”), and a single cause was sought that applied to the larger kind. If more than one cause could be at work, then nothing is gained by grouping together the kinds that exhibit the attribute.

Further, the example of long-life is problematic, in so far as Aristotle’s treatment of *makrobia* in *Long.* suggests a greater unity in its explanation (not to mention that it is the *wet*, not the *dry*, that is responsible). The *heteron ti* at the end of (7) suggests that the example is intended to be illustrative, and may not reflect Aristotle’s considered view on *makrobia*.

Still further, this conclusion raises difficult questions regarding the form/kind groupings to which unified causal explanations apply. For example, if we think that the study of animals is a unified science, treating a single kind of thing, then we should expect shared predicates to be similarly caused. If this is not the case, at what level of kind/form divisions should we expect that similarity to hold? And, perhaps worse, which “forms” should we look to as marking off common causes? While Aristotle introduces the *megista genê* as useful divisions within the animal world for grouping together the discussion of common attributes, he clearly does recognize that *some* attributes are present across these divisions that are commonly caused (see discussion in *PA* I.1).

Perhaps we could read *form* in passage (7) as picking out *infima species*, such that animals that are the same in form at that lowest level (e.g. two humans) must have their attributes commonly caused, but not necessarily at higher levels of generality.

B.4 CONCLUSION

The final comments of the schematic passage ((11) above) favor interpreting the entire passage as illustrating the notion that the same effect may have different causes in different forms of things. This possibility is discussed aporetically in II.16, but is not the notion that is illustrated in the leaf-shedding example immediately prior to the schematic passage. In the leaf-shedding example, different subjects that exhibit the same attribute are grouped together to form a wider kind, to which a single cause belongs that is explanatory of the attribute in each of the subjects. Thus we are left to ask, is the schematic passage intended to illustrate the case of (i) different subjects having different causes of the same attribute, or (ii) different subjects belonging to a single wider kind, and thus possessing the same cause? The possibility of the same effect having more than one cause is considered in II.13, but there Aristotle concludes that a different cause actually implies a different effect, certain superficial similarities notwithstanding, in so far as the cause figures into the definition of the effect.²⁹² The example there is pride, which in certain different people is caused by different things. In II.13 Aristotle concludes that there would be two different forms of pride in that case. (A similar argument can

²⁹² See also II.17, 99a21-2, where Aristotle again states that the cause of an attribute figures into the attribute's definition.

be made in regards to Aristotle's discussion of what it means for an animal to be water-dwelling (*enhudron*).)

APPENDIX C

ARISTOTLE'S *MEGISTA GENÊ*

In *HA* I.6 Aristotle turns from a discussion of the *differentiae* exhibited by animals to a discussion of the very large kinds (*megista genê*) into which animals have been divided. These very large kinds play an instrumental role in Aristotle's biological writings. They are typically used to structure discussions of important features under study: for a given feature, the discussion often proceeds from one very large kind to another. This practice is defended in *PA* I, where Aristotle argues that a proper understanding of a feature exhibited by an animal must include the identification of the highest level kind in which the feature is present, and the explanation must be applicable at that level of generality. Interestingly, it is not clear which kinds Aristotle believed qualified as *megista genê*. On one reading of the passage in *HA* I.6, Aristotle seems to exclude two kinds of animals traditionally thought to be *megista genê*: four-footed live-bearing and four-footed egg-bearing animals. But his comments elsewhere, not to mention his *practice* in the biology, seem to suggest that these two kinds do in fact qualify as *megista genê*. In what follows I provide a reading of the passage that shows that Aristotle did not view four-footed live-bearing and four-footed egg-bearing animals as very large kinds. I further

show that Aristotle's use of these differentiae throughout his biology need not require us to take them as marking off very large kinds.

C.1 THE PASSAGE: *HA* I.6, 490B7-491A6

Here is Balme's text of the passage in question. I've divided the text into 6 sections, each of which will be commented on separately below.

- 490b7 (1) γένη δὲ μέγιστα τῶν ζώων, εἰς ἃ διήρηται τᾶλλα
ζῶα, τὰ δ' ἐστίν, ἐν μὲν ὀρνίθων, ἐν δ' ἰχθύων, ἄλλο δὲ
κῆτος. Ταῦτα μὲν οὖν πάντα ἑναιμά ἐστιν. ἄλλο δὲ γένος
b10 ἐστὶ τὸ τῶν ὀστρακοδέρμων, ὃ καλεῖται ὄστρεον· ἄλλο τὸ τῶν
μαλακοστράκων, ἀνώνυμον ἐνὶ ὀνόματι, οἷον κάραβοι καὶ
γένη τινὰ καρκίνων καὶ ἀστακῶν· ἄλλο τὸ τῶν μαλακίων,
οἷον τευθίδες τε καὶ τεῦθοι καὶ σηπία· ἕτερον τὸ τῶν ἐντό-
μων. Ταῦτα δὲ πάντα μὲν ἐστὶν ἄναιμα, ὅσα δὲ πόδας
b15 ἔχει, πολύποδα· τῶν δ' ἐντόμων ἓν καὶ πτηνά ἐστιν. (2) τῶν
δὲ λοιπῶν ζώων οὐκ ἔστι τὰ γένη μεγάλα· οὐ γὰρ περιέχει
πολλὰ εἶδη ἐν εἶδος, ἀλλὰ τὸ μὲν ἐστὶν ἀπλοῦν αὐτὸ οὐκ
ἔχον διαφορὰν τὸ εἶδος, οἷον ἄνθρωπος, τὰ δ' ἔχει μὲν,
ἀλλ' ἀνώνυμα τὰ εἶδη. (3) ἔστι γὰρ τὰ τετράποδα καὶ μὴ
b20 πτερωτὰ ἑναιμα μὲν πάντα, ἀλλὰ τὰ μὲν ζωοτόκα τὰ δ'
ῥωτοτόκα αὐτῶν. ὅσα μὲν οὖν ζωοτόκα, οὐ πάντα τρίχας ἔχει,

ὅσα δ' ὠτόκα φολίδας ἔχει · ἔστι δ' ἡ φολίς ὅμοιον
 χώρα λεπίδος. (4) ἄπουν δὲ φύσει ἐστὶν ἔναιμον πεζὸν τὸ τῶν
 ὄφρων γένος· ἔστι δὲ τοῦτο φολιδωτόν. ἀλλ' οἱ μὲν ἄλλοι
 b25 ὠτοκοῦσιν ὄφεις, ἡ δ' ἔχιδνα μόνον ζωοτοκεῖ. τὰ μὲν γὰρ
 ζωοτοκοῦντα οὐ πάντα τρίχας ἔχει· καὶ γὰρ τῶν ἰχθύων
 τινὲς ζωοτοκοῦσιν· ὅσα μέντοι ἔχει τρίχας πάντα ζωοτοκεῖ.
 τριχῶν γὰρ τι εἶδος θετέον καὶ τὰς ἀκανθώδεις τρίχας
 οἷας οἱ χερσαῖοι ἔχουσιν ἐχῖνοι καὶ οἱ ὕστριχες· τριχὸς γὰρ
 b30 χρεῖαν παρέχουσιν, ἀλλ' οὐ ποδῶν, ὥσπερ αἱ τῶν θαλαττίων.
 (5) τοῦ δὲ γένους τοῦ τῶν τετραπόδων ζώων καὶ ζωοτόκων εἶδη
 μὲν ἐστὶ πολλά, ἀνώνυμα δέ· ἀλλὰ καθ' ἕκαστον αὐτῶν
 ὥς εἰπεῖν, ὥσπερ ἄνθρωπος εἴρηται, λέων, ἔλαφος, ἵππος,
 κύων καὶ τᾶλλα τοῦτον τὸν τρόπον, ἐπεὶ ἐστὶν ἐν τι γένος καὶ
 491a1 ἐπὶ τοῖς λοφούροις καλουμένοις, οἷον ἵππῳ καὶ ὄνῳ καὶ ὀρεῖ
 καὶ γίννῳ καὶ ἱννῳ καὶ ταῖς ἐν Συρίᾳ καλουμέναις ἡμίονοις,
 αἱ καλοῦνται ἡμίονοι δι' ὁμοιότητα, οὐκ οὔσαι ἀπλῶς τὸ αὐτὸ
 εἶδος· καὶ γὰρ ὀχεύονται καὶ γεννῶνται ἐξ ἀλλήλων. (6) διὸ
 a5 καὶ χωρὶς λαμβάνοντας ἀνάγκη θεωρεῖν ἐκάστου τὴν φύσιν
 αὐτῶν.

(See below for translations of each section)

C.2 ANALYSIS OF THE TEXT

(1) 490b7-15

- 490b7 Γένη δὲ μέγιστα τῶν ζώων, εἰς ἃ διήρηται τᾶλλα
ζῶα, τὰδ' ἐστίν, ἐν μὲν ὀρνίθων, ἐν δ' ἰχθύων, ἄλλο δὲ
κῆτος. Ταῦτα μὲν οὖν πάντα ἔναιμά ἐστιν. Ἄλλο δὲ γένος
b10 ἐστὶ τὸ τῶν ὀστρακοδέρμων, ὃ καλεῖται ὄστρεον· ἄλλο τὸ τῶν
μαλακοστράκων, ἀνώνυμον ἐνὶ ὀνόματι, οἷον κάραβοι καὶ
γένη τινὰ καρκίνων καὶ ἀστακῶν· ἄλλο τὸ τῶν μαλακίων,
οἷον τευθίδες τε καὶ τεῦθοι καὶ σηπῖαι· ἕτερον τὸ τῶν ἐντό-
μων. Ταῦτα δὲ πάντα μέν ἐστιν ἄναιμα, ὅσα δὲ πόδας
b15 ἔχει, πολύποδα· τῶν δ' ἐντόμων ἓν καὶ πτηνά ἐστιν.

Very large kinds of animals, into which many/some/other²⁹³ animals have been divided, are these: one is of birds, one of fishes, another of cetaceans. All these are blooded. Another kind is that of the hard-shelled, which are called oyster. Another is that of the soft-shelled, unnamed by one name, for example crayfish

²⁹³ Balme (forthcoming, *ad loc.*) reads the *talla* here as contrasting with the *loipa* in b16: the animals here referred to are the very ones that fall into very large kinds, whichever they may be. Louis (1964, *ad loc.*, n6) takes the *talla* as opposed to the *allo de genos* in b9, which introduces the bloodless very large kinds, and thus as referring to the blooded animals that fall into very large kinds. He translates “les animaux autres que les non sanguins.” Gotthelf translates *talla* as “some,” thereby stressing that not all animals fall into very large kinds. This reading leaves room for there being other very large kinds, in addition to the ones in the following list, e.g. four-footed live-bearing and four-footed egg-bearing. Topher Kurfess plausibly suggests amending *talla* to *polla*, but with no manuscript support.

and some kinds of crabs and lobsters. Another is that of the soft-bodied, for example *teuthides*, *teuthoi*, and squids. A different one is that of the insects. These are all bloodless, and as many as are footed are many-footed; some of the insects are winged.

The passage begins by introducing “very large kinds” (*megista genê*) into which animals have been divided. The lack of a definite article with *genê* perhaps suggests that the following list is not exhaustive, i.e. not *the* very large kinds, but rather just a list of very large kinds. But, while the grammar allows for this, nothing else in these opening lines suggests that the list is not exhaustive, and, as we shall see below, Aristotle’s further comment that the remaining kinds of animals are no longer *megala* (b16) suggests that it *is* exhaustive. It would not make sense for Aristotle to list only *some* of the very large kinds, and then say that the remaining kinds (which would thus include some very large ones) are not very large.²⁹⁴

The perfect tense of the verb *diêrêtai* (b7) suggests that the list is of very large kinds that have already been recognized in one way or another, and probably reflects popular usage.²⁹⁵ But, while it may be true that *bird* and *fish* (and perhaps even *cetacean* and *insect*) were commonly used terms and recognized kinds, it is not at all clear that the other kinds listed enjoyed such a

²⁹⁴ However, Gotthelf argues that it is only the remaining *popularly recognized* kinds that are not *megala*, and that Aristotle is free to argue for the existence of additional, not commonly recognized, very large kinds. Gotthelf argues that Aristotle does just this with four-footed live-bearing and four-footed egg-bearing. I will address Gotthelf’s arguments in what follows below.

²⁹⁵ Gotthelf 2012, pp 296-297. This reading of *diêrêtai* is important for Gotthelf’s interpretation, because it allows him to explain the absence of four-footed live-bearing and four-footed egg-laying from this list by making reference to popular usage: those are kinds that were not commonly recognized, and so not included in that list. As we shall see, Gotthelf goes on to read in the passage an argument for the inclusion of these two additional kinds.

status in popular usage. In fact, the terms *ostrakoderma*, *malakostraka*, and *malakia* are merely substantive adjectives, descriptive terms standing in the place for actual names. In the case of *ostrakoderma*, Aristotle specifies that these animals “are called” (*kaleitai*) oysters, as if the term *ostrakoderma* was *not* part of popular usage. Similarly, in the case of *malakostraka*, Aristotle states that this kind is “unnamed by a single name” (b11), which suggests that there was no single term recognized in popular usage that unified the animals that fall into the kind.²⁹⁶ In fact, that Aristotle felt it necessary to include examples of these three kinds of animals, while he felt no such need for bird, fish, cetacean, or insect, suggests that these terms refer to animal kinds that were not popularly recognized as such. If we are to give force to the perfect tense of the verb *diêrêtai*, it seems more likely that Aristotle is stressing that these are the very large kinds into which animals have been divided *by us*, i.e. by Aristotle and members of his school. *Others* may call the *ostrakoderma* “oysters,” and may refer to the *malakostraka* by various names, depending on the animal in question, but *Aristotle* (and presumably his school) will not.

(2) 490b15-19

b15

τῶν

δὲ λοιπῶν ζώων οὐκ ἔστι τὰ γένη μεγάλα· οὐ γὰρ περιέχει
πολλὰ εἶδη ἐν εἶδος, ἀλλὰ τὸ μὲν ἐστὶν ἀπλοῦν αὐτὸ οὐκ
ἔχον διαφορὰν τὸ εἶδος, οἷον ἄνθρωπος, τὰ δ' ἔχει μὲν,
ἀλλ' ἀνώνυμα τὰ εἶδη.

²⁹⁶ This need not imply that these animals were not recognized as belonging to a single kind, but the lack of a name surely suggests it.

Of the remaining animals, the kinds are not large; for one form does not embrace many forms, but in one case it is itself simple, the form not having differentiation, for example man, while other cases have <differentiation>, but the forms are unnamed.

Aristotle explicitly states that, for the remaining animals (i.e. the animals not falling into any of the aforementioned kinds) the kinds are not large (presumably *megala* in b16 has the same extension as *megista* in b7). This does not mean that the remaining animals do not divide into *kinds*, but only that the kinds are not *large* (or *very large*). The reason he gives is that “one form does not embrace many forms,” which, despite the peculiarity of the use of *eidos* for both the higher and lower levels of classification, agrees with the general notions of *genos* and *eidos* sketched out at the beginning of *HA* I.1. *Genos* implies a multiplicity of forms that are unified by some form of similarity. Recall that in I.1 Aristotle stated that forms of animals that differ from one another by “the more and the less” constitute a single kind, while forms that are similar only by analogy belong to different kinds. Recall the language at 486a21:

Some <parts> are on the one hand the same, but on the other hand they differ by excess and defect, as many as the kind is the same. I mean by kind e.g. bird, and fish. For each of these has difference according to kind, and there are many forms of fishes and birds.

The relationship between a kind and its forms is one of sameness *and* difference: all the forms of a kind share a certain similarity, but they also differ from one another, generally by the more and the less. For example, all birds possess *wings*, but the wings of different forms of bird will differ, some being longer, others shorter, some stronger, others weaker, etc. The notion of “one form embracing many forms” reflects this relationship of sameness and difference: the higher, embracing form will be more general or abstract in nature, while the embraced forms will all be the same as one another *at that higher level of generality*, while, at the more particular level, they exhibit differences. Thus, for the remaining animals that fail to divide into very large kinds, there is no single, higher level form that they all share. Presumably the level of generality at which this higher-level form would have to operate is quite high, if the kind is to be *very large*. That is, it seems quite unlikely that none of the remaining animals can be organized into a kind *at some level of generality*. What’s at stake is the exact sense that Aristotle used the phrase *megiston genos*. The notion of “one form embracing many forms” seems common to the notions of both *genos* and *megiston genos*. What’s the difference? Is it that, in the case of a *megiston genos*, there are a *great many* forms embraced? Or is it that a kind is very large if it embraces forms that themselves have differentiation – kinds and sub-kinds?

In the present passage Aristotle gives two reasons why, for the remaining animals, “one form does not embrace many forms”: (i) the form is simple and does not have any differentiation, and (ii) the forms do have differentiation, but the forms are unnamed. Regarding (i), these are cases where the animal kind in question simply does not exhibit the sort of multiplicity of forms that might render it a very large kind. Aristotle’s stock example of this, and the one he offers here, is man. He believed that man differs from the rest of the animals significantly enough to exclude it from membership in any other existing kind, and there are no

sub-kinds of man. Thus man is a kind of its own, as it were – a *genos* that embraces a single *eidos*.

Regarding (ii), there is some ambiguity regarding whether the forms that are unnamed are the higher level, embracing forms, or the lower level, embraced forms. The *ta de* in b18 is coordinate with the *to men* in b17, which suggests that the implied subject in both cases is the higher level, embracing forms. In b17 this higher level form has no differentiation, and thus has no lower level forms to embrace. In b18 the higher level forms do have differentiation, suggesting that there are lower level forms to embrace, and thus the possibility of a very large kind. The grammar of the next clause renders it ambiguous whether the *ta eidê* in b18 are the higher level forms implied in the *ta de* in b18, or the lower level forms that are embraced by the *ta de* forms. Balme points out that the parallel construction of the *men/de* clauses suggests that *ta eidê* in b19 are in apposition to *ta de* in b18, just as *to men* in b17 is in apposition to *to eidos* in b18. On this reading it is the higher level, embracing forms that are unnamed. But, while the construction may suggest this reading, it does not require it.

The question is whether Aristotle held that unnamed embracing forms or unnamed embraced forms pose a challenge to a kind's status as very large. While an unnamed, and thus presumably unrecognized, higher level, embracing form would pose a challenge to the natural philosopher and would prevent the identification of the proper level of generality at which a given explanation should aim (as in the case of alternating proportions discussed in *APo.* I.5), Aristotle repeatedly states that we must be on the look out for such unnamed kinds so that we do not fall into this error.²⁹⁷ That is, the fact that such kinds are unnamed should not prevent us from

²⁹⁷ See *PA* I.4, 644b1ff., where Aristotle explicitly uses the language of an “unnamed” form “embracing” other forms “like a kind.” The message from this passage is clearly that one

using them, however they are marked off, in our research. That they are unnamed does not seem to stand in the way of these kinds being taken *as kinds* (as in the case of the *malakostraka*, which Aristotle specifically states are “unnamed by one name”). Thus it seems unlikely that Aristotle is here suggesting that being unnamed is something that prevents these “forms having differentiation” from being kinds, or even very large kinds. Rather, if such forms are unnamed, it simply reflects a short-coming in popular usage and a lack of knowledge about the animal world, one that should not stand in the way of the natural philosopher.²⁹⁸

Instead we can read the passage as stating that it is the lower level, embraced forms that are unnamed. But unnamed how? The lowest level forms (the individual species of animal) surely have names, and it is these forms that are embraced by the higher form. In what sense, then, are they unnamed? I suggest that it is the absence of recognized (and thus named) *intermediate* kinds – between the highest level *genos* and the *infima species* – that prevent the remaining kinds of animals from reaching the status of *megista genê*. Again, Aristotle’s comments on the *malakostraka* are revealing: while the higher-level kind is “unnamed by a single name” (*malakostraka* seems not to be a true name, but a descriptive name-like phrase), it embraces *other recognized kinds*, such as “crayfish, some kinds of crabs and lobsters” (b11-12). This is what is lacking in the other forms of animals, and this is explicitly what he states is lacking, at b31-32, in the case of four-footed, live-bearing animals: there are no recognized further divisions of the kind beyond the individual *infima species* (with the exception, perhaps, of

should not let the fact that a kind (or a form “like a kind”) is unnamed be an impediment to treating it *as a kind*.

²⁹⁸ One might argue that the higher level, unnamed kinds are unnamed in popular usage only, and thus Aristotle may still use these kinds, even if they are not popularly recognized as such. But if this were the case, it is not clear why Aristotle specifically states that the remaining kinds are no longer large.

the *lophoura*, on which see below). What's at stake is not the status of a form with differentiation being a *genos*, but rather being a *megiston genos*. It is the existence of (many?) intermediate kinds that render a higher level kind *megiston*.

I maintain that the grammar of the passage allows for this reading, but does it make sense with the rest of the passage? Let's continue and see.

(3) 490b19-23

Ἔστι γὰρ τὰ τετράποδα καὶ μὴ
b20 πτερωτὰ ἔναιμα μὲν πάντα, ἀλλὰ τὰ μὲν ζωοτόκα τὰ
 δ' ὠοτόκα αὐτῶν. Ὅσα μὲν οὖν ζωοτόκα, πάντα τρίχας
 ἔχει, ὅσα δ' ὠοτόκα, φολίδας· ἔστι δ' ἡ φολὶς ὅμοιον
 χώρα λεπίδος.

For, the four-footed and non-winged ones are all blooded, but some of them are live-bearing while others are egg-bearing. So then, as many as are live-bearing all have hair, but as many as are egg-bearing, horny scales; the horny scale is similar in place to the fish scale.

The *gar* in b19 indicates that, in some sense, what follows is meant to explicate the reasons why the remaining kinds are not great. Presumably four-footed and non-winged is offered as an example of a putative kind, and the fact that all these animals are blooded serves as further evidence in favor of granting it this status. “But” (*alla*), Aristotle continues, these animals

do not all share a common mode of reproduction. The difference live-bearing/egg-bearing suggests that perhaps this grouping does not exhibit the sort of more-or-less unity that a kind demands. Thus *four-footed and not winged* marks off a “form with differentiation,” but this differentiation extends beyond the more-or-less form of difference necessary to render it a single kind.

The *hosa* in the next sentence (b21) presumably modifies “four-footed and non-winged” from above, but the *men oun* suggests that a new point is being made, and that is: all four-footed live-bearers have hair, while all four-footed egg-bearers have horny scales. This fact may be taken to suggest that *four-footed live-bearing* and *four-footed egg-bearing* may succeed in marking off a real kind, since the further difference *hairy/horny-scaled* follows them. The further, seemingly parenthetical, remark about horny scales occupying the same place as fish-scales also seems to suggest that, just as fish-scales are unique to the *megiston genos* fish (as also feather is to bird), so too the correlation of hair with four-footed live-bearing, and horny-scale with four-footed egg-bearing may uniquely mark off a kind.

I suggest, instead, that the new point that the *men oun* sentence beginning at b21 has us consider is not whether four-footed live-bearing and four-footed egg-bearing mark off kinds, but rather whether *hairy* and *horny-scaled* do. *Four-footed and not-winged* failed to mark off a kind due to the difference *live-bearing/egg-bearing*, but it came to light that all four-footed live-bearers are hairy, and all four-footed egg-bearers are horny-scaled. So perhaps *hairy* and *horny-scaled* mark off kinds. These too will fail. The key is the argument regarding the snake that follows.

(4) 490b23-30

Ἄπουν δὲ φύσει ἐστὶν ἔναιμον πεζὸν τὸ τῶν
ὄφεων γένος· ἔστι δὲ τοῦτο φολιδωτόν. Ἄλλ' οἱ μὲν ἄλλοι
b25 ὠοτοκοῦσιν ὄφεις, ἢ δ' ἔχιδνα μόνον ζωοτοκεῖ. Τὰ μὲν γὰρ
ζωοτοκοῦντα οὐ πάντα τρίχας ἔχει· καὶ γὰρ τῶν ἰχθύων
τινὲς ζωοτοκοῦσιν· ὅσα μέντοι ἔχει τρίχας, ἅπαντα ζωοτοκεῖ.
Τριχῶν γάρ τι εἶδος θετέον καὶ τὰς ἀκανθώδεις τρίχας,
οἷας οἱ χερσαῖοι ἔχουσιν ἐχῖνοι καὶ οἱ ὕστριχες· τριχὸς γὰρ
b30 χρεῖαν παρέχουσιν, ἀλλ' οὐ ποδῶν, ὥσπερ αἱ τῶν θαλαττίων.

Footless by nature, blooded and land-dwelling is the kind of snakes, and this
<kind> is horny scaled. But while the other snakes are egg-bearing, the viper
alone is live-bearing. For not all live-bearing ones have hair, for even some of the
fishes are live-bearing; however, as many as have hair, all are live-bearing. For
one must put as a kind of hair the spiny hairs of the sort that the hedgehog and
porcupine have; for this is their function, but not of feet, as in the case of the sea
urchins.

The exact function of this passage has long eluded commentators. What seems clear is
that Aristotle offers the snake as an example of a kind of animal that is horny-scaled,²⁹⁹ but also

²⁹⁹ Aristotle also specifically points out that snakes are *blooded* and *land-dwelling*, as were the four-footed live-bearers and four-footed egg-bearers. The first difference listed, *footless*,

exhibits the difference live-bearing/egg-bearing. He drives this point home by stating that not all live-bearing animals are hairy, and that even some fish (i.e. some fish-scaled animals) are live-bearing.³⁰⁰ If we take the earlier statement regarding four-footed and non-winged animals exhibiting the difference live-bearing/egg-bearing as a mark against four-footed and non-winged as marking off a kind, then the same idea is at work here. Since all four-footed live-bearing animals are hairy and all four-footed egg-bearing animals are horny scaled, perhaps *hairy* and *horny-scaled* mark off kinds, but the snakes, which are horny-scaled, prevent this, because the single mode of reproduction *egg-bearing* does not follow.

The comment on the hedgehog, porcupine, and sea urchin is best understood as a parenthetical aside. The spikey hair of the hedgehog and porcupine are forms of hair, and, unlike the similar looking spikey “hairs” of the sea urchin, they do not act as feet, but rather serve as outer covering. There also seems to be a play on the Greek names of hedgehogs (*hoi chersaioi echinai*) and sea urchins (*hai thalattiai echinai*), which, on the surface, could indicate a sort of kinship between the animals.³⁰¹ The point of the passage is that the hedgehog and porcupine, both live-bearing animals, are hairy, while the sea urchin, which is egg bearing, is not really hairy. Thus the correlation of hairy with live-bearing, holds.

(5) 490b31-491a4

is perhaps meant to have us consider whether the number of feet is an important difference or not. For if the distinct mode of reproduction *egg-bearing* belonged to snakes, then *horny-scaled* would turn out to be the common differentia (along with *blooded* and *land-dwelling*), and number of feet would fall by the wayside.

³⁰⁰ Of course, if the difference *live-bearing/egg-bearing* were sufficient to break up a kind (as was suggested for *four-footed and not winged*), then fish would not qualify as a kind.

³⁰¹ This point was brought to my attention by Topher Kurfess.

Τοῦ δὲ γένους τοῦ τῶν τετραπόδων ζώων καὶ ζωοτόκων εἶδη
 μέν ἐστι πολλά, ἀνώνυμα δέ· ἀλλὰ καθ' ἕκαστον αὐτῶν
 ὡς εἰπεῖν, ὥσπερ ἄνθρωπος εἴρηται, λέων, ἔλαφος, ἵππος,
 κύων καὶ τᾶλλα τοῦτον τὸν τρόπον, ἐπεὶ ἐστὶν ἓν τι γένος μόνον
 491a1 ἐπὶ τοῖς λοφούροις καλουμένοις, οἷον ἵππῳ καὶ ὄνῳ καὶ
 ὀρεῖ καὶ γίνῳ [καὶ ἴνῳ] καὶ ταῖς ἐν Συρίᾳ καλουμέναις
 ἡμίονοις, αἱ καλοῦνται ἡμίονοι δι' ὁμοιότητα, οὐκ οὔσαι ἀπλῶς
 τὸ αὐτὸ εἶδος· καὶ γὰρ ὀχεύονται καὶ γεννῶνται ἐξ ἀλλήλων.

Regarding the kind of four-footed live-bearing animals, there are many forms, but
 they are unnamed. Rather, according to each of them, so to speak, just as man was
 spoken of, <so also> lion, elephant, horse, dog, and the others in the same way.
 Although there is one sort of kind in the case of the so-called *lophoura*, for
 example horse,

The passage begins by referring to four-footed live-bearing as a kind, but this need not
 indicate that it is a *very large* kind. And in fact Aristotle immediately cites one of the two criteria
 given above as the reason why the kind is not very large: the forms of the kind are unnamed, i.e.
 they do not organize themselves into recognized intermediate kinds.³⁰² Rather, each individual
 species must be studied separately. He allows that there may be one recognized intermediate
 kind, the *lophoura*, but he refers to this only as a sort of kind (*ti genos*), and in any event it seems

³⁰² Here, unlike passage (2) above, the grammar requires that it is the lower, embraced
 kinds that are unnamed. Gotthelf prefers to read the first as a reference to unnamed
 embracing forms, and the second to unnamed embraced forms.

that one intermediate kind is not sufficient to render the higher kind very large.

(6) 491a4-6

Διὸ

a5 καὶ χωρὶς λαμβάνοντας ἀνάγκη θεωρεῖν ἐκάστου τὴν φύσιν
αὐτῶν.

Hence it is necessary to study the nature of each of them by grasping them separately.

The *dio* in a4 presumably refers to the fact that the many forms of four-footed live-bearing animals are unnamed. It is because these animals, diverse in form, do not organize themselves into intermediate kinds that we are restricted from saying very much about them at a high level, and thus must study each form individually.

This does not mean that the differentia group *four-footed live-bearing* cannot be used to mark off animals for study. In fact it can: it provides a useful means for dividing the remaining animals to be studied (especially the difference *live-bearing*). But, nonetheless, the animals so divided will have to be studied individually. The absence of higher level, embracing form restricts the extent to which one can make generalizations about these animals.

C.3 THE EVIDENCE FROM *HA* II.15

In *HA* II.15 the discussion turns from the external parts of blooded animals to the internal parts. Prior to discussing these parts Aristotle includes a brief comment on the order in which the different kinds of animals should be treated. In it he specifically uses the phrase *megista genê*, and lists some of the animal kinds discussed above. Here is the text Balme prints, followed by my translation:

- 505b23 τὰ μὲν οὖν ἔξω μόρια, καὶ πόσα καὶ ποῖα τῶν ἐναί-
μων ζώων, καὶ τίνας ἔχει πρὸς ἀλλήλα διαφοράς, εἴρηται.
- b25 τὰ δ' ἐντὸς πῶς ἔχει, λεκτέον ἐν τοῖς ἐναίμοις ζώοις
πρῶτον· τούτῳ γὰρ διαφέρει τὰ μέγιστα γένη πρὸς τὰ λοιπὰ
τῶν ἄλλων ζώων, τῷ τὰ μὲν ἔναιμα τὰ δ' ἄναιμα εἶναι.
ἔστι δὲ ταῦτα ἄνθρωπος τε καὶ τὰ ζωοτόκα τῶν τετραπόδων,
ἔτι δὲ καὶ τὰ ὀτοτόκα τῶν τετραπόδων καὶ ὄρνις καὶ ἰχθύς
- b30 καὶ κῆτος, καὶ εἴ τι ἄλλο ἀνώνυμόν ἐστι διὰ τὸ μὴ εἶναι
γένος ἄλλ' ἀπλοῦν τὸ εἶδος ἐπὶ τῶν καθ' ἕκαστον, οἷον ὄφεις
καὶ κροκόδειλος.

So then the external parts of blooded animals, both how many and of what sort, and which differences they have compared to one another, have been spoken of. How the internal parts are, we must speak of the blooded animals first; for by this the very large kinds differ compared to the remaining other animals: in so far as some are blooded while others are bloodless. And these are man and also the live-

bearing of the four-footed, and further also the egg-bearing of the four footed, and bird, fish, and cetacean, and if there is any other that is unnamed because of not being a kind, but rather the form is simple in the case of each individual, for example the snake and the crocodile.

The passage is usually taken as stating that the very large kinds differ from the other animals in so far as the very large kinds are blooded, while the remaining animals that do not fall into very large kinds are bloodless.³⁰³ This conflicts with the list of very large kinds given in *HA* I.6, which includes four bloodless kinds animals. Balme brackets the passage (from b26-32), calling it “an early interpolation by a systematizing Peripatetic”³⁰⁴, and lists the following difficulties: (1) Why are only the blooded kinds called very large, while elsewhere bloodless kinds are included? (2) Why is man included in the list of very large kinds? (3) How can snake and crocodile exemplify separate forms that must be treated separately?

I propose that the list of animal kinds at b28 is not intended as a list of the very large kinds, but rather is simply a list of *blooded animals*, as the comments at b25 would have us expect. The very large kinds are mentioned at b26 in order to provide some sort of rationale for why the investigation should begin with blooded animals. Read in this way, Balme’s problems (1) and (2) are resolved. Problem (3), however, remains, and resolving it I believe requires some textual emendation.

As mentioned above, many scholars read the passage as asserting that the very large kinds are blooded, while the remaining other animals are bloodless. This interpretation is based

³⁰³ Examples: Peck, Thompson, Louis, Balme

³⁰⁴ Balme forthcoming, *ad loc.*, 505b26-32

on reading the antecedent of the *ta men* in b27 as *ta megista genê* in b26, and the antecedent of the *ta de* as *ta loipa tôn allôn zôôn*. This gives the translation: “the former (i.e. the *megista genê*) are blooded while the latter (i.e. the remaining other animals) are bloodless.” However, it is possible to read both the *ta men* and the *ta de* as referring to the *megista genê*. The translation would then read:

For it is by this that the very large kinds differ from the remaining other animals, in so far as some [of the very large kinds] are blooded while others [of the very large kinds] are bloodless.

In this case, Aristotle is simply pointing out that the difference blooded/bloodless is present among the very large kinds, but not among the remaining other animals. The *gar* at b26 indicates that the statement is offered as an explanation of sorts for why the internal parts of blooded animals should be treated first. Perhaps Aristotle’s point is that since the very large kinds are divided into blooded and bloodless, the treatment of the internal parts should follow this division as well. However the explanatory force of the *gar* is read, the entire statement seems to be something of a parenthetical aside, such that the *esti de tauta* in b28 picks up the thought left off at b25-26: “we must speak of the blooded animals first . . . And these are . . .” Thus the list of animals that commences at b28 is a list of *blooded animals*: man, four-footed live-bearing, four-footed egg-bearing, birds, fish, cetaceans, and any other (blooded) animal whose kind is unnamed because the form is simple and thus must be treated individually.

If the passage is read in this way, then Balme’s problem (1) is resolved because the *megista genê* are no longer restricted to the blooded animals, but include the difference

blooded/bloodless. Problem (2) is also resolved, because the list at b28 is not of the *megista genê*, but of blooded animals, so the inclusion of man on the list is not problematic. That some of the kinds in the list are very large kinds (e.g. bird, fish, cetacean) need not indicate that all of them are. And in fact, that the list ends with a reference to animals that are simple in form (i.e. definitively *not* a very large kind) confirms that the list is not one of *megista genê*. As discussed above, the use of the differentia group *four-footed live-bearing* and *four-footed egg-bearing* need not impart to them the status of *megista genê*.

But is it true that the remaining animals that do not fall into one of the *megista genê* are either all blooded or all bloodless? Aristotle never says this directly, but the animals typically cited as falling outside of the very large kinds are man and snakes, both of which are blooded. This would suggest that *all* the animals that fall outside of the very large kinds are blooded.

In *HA* IV.7, at the end of his treatment of the parts of bloodless animals, Aristotle does refer to “some odd animals” (*henia zôa peritta*) in the sea which, due to their scarcity (*dia to spania*) cannot be placed into a kind (*ouk esti theinai eis genos*) (532b18). That this statement comes at the end of the treatment of bloodless animals might suggest that these odd animals too are bloodless. However, the completion of the treatment of bloodless animals also marks the completion of the treatment of *all* animals, both blooded and bloodless. Aristotle’s concluding remarks immediately following the passage on odd animals confirms this:

So then the parts of all animals, both external and internal, regarding each kind, both peculiar and common, hold in this manner.

Thus the placement of the odd animals at the end of this discussion does not indicate that Aristotle held them to be bloodless, but rather that he simply saved mention of them for the end of the discussion of all animals. Further, it's not clear that Aristotle held that these odd animals do not actually fall into one of the very large kinds, only that their scarcity prevents us from determining which of the kinds, if any, they fall into.³⁰⁵

Problem (3) is more challenging, since Aristotle speaks of different forms of snakes and crocodiles, and thus they seem to be poor examples of forms without differentiation. In this case emending the text in some way seems necessary. But does this then cast doubt on the rest of the passage? I think it need not. The reading I've offered eliminates any problem concerning the *megista genê* and is in keeping with Aristotle's thought and practice. The *hoion* clause at b31-32 may be read as a confused, late addition by an editor interested in clarifying the preceding statement regarding simple forms, but who failed to pick out forms that were truly simple.

C.4 THE EVIDENCE FROM *HA* V.1

HA V begins the discussion of generation in animals, and includes an extended introduction in which Aristotle discusses, among other things, the order in which the different animals kinds should be discussed.

539a4

ἐπεὶ δὲ διήρηται τὰ γένη

³⁰⁵ See Balme (forthcoming), *ad loc.*

πρότερον, τὸν αὐτὸν τρόπον καὶ νῦν πειρατέον ποιεῖσθαι τὴν
 θεωρίαν· πλὴν τότε μὲν τὴν ἀρχὴν ἐποιούμεθα σκοποῦντες
 περὶ τῶν μερῶν ἀπ' ἀνθρώπου, νῦν δὲ περὶ τούτου τελευταῖον
 λεκτέον διὰ τὸ πλείστην ἔχειν πραγματείαν. πρῶτον δ' ἀρ-
 κτέον ἀπὸ τῶν ὀστρακοδέρμων, μετὰ δὲ ταῦτα περὶ τῶν
 a10 μαλακοστράκων, καὶ τὰ ἄλλα δὴ τοῦτον τὸν τρόπον ἐφεξῆς·
 ἔστι δὲ τὰ τε μαλάκια καὶ τὰ ἔντομα, καὶ μετὰ ταῦτα τὸ
 τῶν ἰχθύων γένος, τό τε ζωοτόκον καὶ τὸ ὠοτόκον αὐτῶν,
 εἶτα τὸ τῶν ὀρνίθων· μετὰ δὲ ταῦτα περὶ τῶν πεζῶν λε-
 κτέον, ὅσα τ' ὠοτόκα καὶ ὅσα ζωοτόκα. ζωοτόκα δ' ἐστὶ
 a15 τῶν τετραπόδων ἔνια, καὶ ἄνθρωπος τῶν διπόδων μόνον.

Since the kinds have been divided earlier, in the same way also now we must
 attempt to make our investigation, Only before we made our beginning of the
 study of parts with man, but now we must speak of this last because it involves
 much work. We must begin first with the *ostrakoderma*, and after these the
malakostraka, and the others in this way in order. And this is both the *malakia*
 and the insects, and after these the kind of fishes, both the live-bearing and the
 egg-bearing of them. Then the [kind] of birds. And after these we must speak of
 the footed/land animals, both as many as are egg-bearing and as many as are live-
 bearing. The live-bearers are some of the four-footed, and man alone is two-
 footed.

Although the phrase *megista genê* is not used, the list of animal kinds offered, and the reference to the kinds “having been divided earlier” (presumably a reference to the passage in I.6), strongly suggests that it is the *megista genê* that are here presented. First in the list are the four bloodless kinds (*ostrakoderma*, *malokostraka*, *malakia*, and insects), then fish (noting both the live-bearing and egg-bearing forms) and bird – two of the blooded kinds. Then notice that he next cites the “footed” or “land-dwelling” animals (*pezôn*), both the egg-bearing and live-bearing among them. He concludes by noting, in what seems to be something of a parenthetical remark, that some of the footed live-bearers are four-footed, while man is the only two-footed live-bearer.

I think it’s important to note that Aristotle does not use *four-footed live-bearing* and *four-footed egg-bearing* to mark off the relevant animals in the same manner as e.g. *bird* and *fish*. Rather, he uses the single differentia *live-bearing/egg-bearing* to divide the land animals (obviously relevant to the discussion on generation to follow), then notes that some of these land-dwelling live-bearers are four-footed. I suggest that the absence of *four-footed live-bearing* and *four-footed egg-bearing* from this list indicates that Aristotle did not see these “differentia groups” as marking off *megista genê*. Rather, just as he states in I.6, the animals that fall into these differentia groups must be treated individually.

But how does Aristotle actually treat these animals in his discussions of generation in *HA* V and VI? Interestingly, his treatment of the egg-bearing land animals is not organized with that of the live-bearing land animals, as the introductory comments lead us to expect. Rather, it comes just after the treatment of the insects, and before that of the birds, which are followed by

the fish, and finally the live-bearing land animals.³⁰⁶ He introduces these animals as the four-footed, blooded, egg-bearers (557b32), and includes a discussion of snakes immediately following them. This discussion ends book V. Book VI begins by discussing the birds. The first sentence of book VI looks back at what has been discussed, and mentions specifically the generation of snakes, insects, and four-footed egg-bearers (558b8). The actual discussion in book V of the egg-bearing land animals is short (557b31-558a24, 25 lines), and mentions 3 different kinds of animals: the tortoise (both the fresh-water and sea varieties), lizards, and the crocodile (both the land and river varieties). Almost nothing is said of these animals at the level of *four-footed, blooded, egg-bearer*.³⁰⁷ Instead discussions of the egg-laying and incubation habits of these animals takes place at the level of the individual kind.

When the discussion does finally turn to the four-footed live-bearing animals, Aristotle introduces it as follows:

571b3 Περὶ μὲν οὖν τῶν ἄλλων ζώων καὶ πτηνῶν καὶ πλωτῶν,
καὶ περὶ τῶν πεζῶν ὅσα φωτοκεῖ, σχεδὸν εἴρηται περὶ πάντων,
περί τ' ὀχείας καὶ κυήσεως καὶ τῶν ἄλλων τῶν ὁμοιοτρό-
πων τούτοις· περὶ δὲ τῶν πεζῶν ὅσα φωτοκεῖ καὶ περὶ ἀν-
θρώπου λεκτέον τὰ συμβαίνοντα τὸν αὐτὸν τρόπον.

³⁰⁶ The order of the kinds of animals discussed in books V and VI is: *ostrakoderma* (V.15), *malakostraka* (V.17), *malakia* (V.18), insects (V.19-32), egg-bearing land animals (V.33-34), birds (VI.1-9), selacia (i.e. live-bearing fish, VI.10-11), cetaceans (VI.12), egg-bearing fish (VI.13-14), spontaneously generated fish (VI.15) and eels (VI.16), live-bearing land animals (VI.18-37).

³⁰⁷ It may be noted that the varieties of tortoise and crocodile, and even lizard, which seems to mark off a *genos* of animals more than an *eidos*, may suggest the sort of intermediate kinds that I claimed were necessary to elevate the status of a *genos* to *megiston*.

So then regarding the other animals, both the fliers and the swimmers, and regarding the footed animals, as many as are egg-bearings, we have just about spoken of them all. Regarding their coupling and *kuêseôs* and the other matters similar to these. But regarding the footed animals, as many as are live-bearing, and regarding man, we must speak of their attributes in the same way.

Note first that the reference back to the four-footed egg-bearing animals is to the *footed/land* animals, as many as are *egg-bearing*.³⁰⁸ That is, *four-footed egg-bearing* is not used to mark these off, instead a different set of (admittedly related) differentiae are used. This same formula is then repeated to introduce the four-footed live-bearers – again, a combination of *pezon* and *zôôtoka*. This variation in marking off the relevant animals to be discussed suggests that Aristotle did not recognize *four-footed egg-bearing/live-bearing* as marking off very large kinds, at least not in the same way as *bird* or *fish*, or even *ostrakoderma*, *malakostraka*, and *malakia* do. Not only is there no single, popularly recognized name for these animals, there is further no single name-like-phrase or substantive adjective. Sometimes they are identified simply as four-footed, other times by their mode of reproduction, sometimes quantified as land animals, and sometimes by some combination of these. This suggests that Aristotle is grouping them by shared differentiae that are relevant to the discussion at hand (in this case generation), and not by a recognized grouping into kinds.

³⁰⁸ Also note that Aristotle groups the animals previously discussed by their mode of locomotion – *fliers* and *swimmers*. Was this the underlying principle shaping the previous discussion? I do not think so. Rather, I think grouping the animals in this way is meant to show that his discussion embraces *all* the different kinds of animals, namely those of the *air*, *sea*, and now *land*.

The actual discussion of the live-bearing land-animals that follows focuses almost exclusively on the different *eidê* of these animals, saying almost nothing of them at the level of *live-bearing land animal*, much less *four-footed live-bearers*.³⁰⁹ And indeed a great many different *eidê* are discussed: horse, cow, pig, sheep, goat, dog, mule, camel, elephant, boar, deer, bear, lion, hyena, rabbit, fox, wolf, cat, mouse. Again, this is in keeping with the statements regarding four-footed live-bearing animals in I.6, namely that each form must be treated separately.

C.5 CONCLUSION

The forgoing considerations suggest that Aristotle did *not* recognize four-footed live-bearing and four-footed egg-bearing animals as *megista genê*. Despite the frequency with which Aristotle uses these differentiae as organizing principles in his discussions, it does not appear that he found enough similarity among the many, various animals that fall under these groupings to treat them as unified kinds, or so the difficult argument regarding the *megista genê* in *HA* I.6 appears to state. Nonetheless, the differentiae *four-footed* (and indeed *footed*), *live-bearing*, and *egg-bearing* may still be used by Aristotle to group animals that do share many similar features, regardless of whether or not the commonality among them sufficiently marks them off as a *megista genê*. Thus it seems that rather little is at stake whether these two groups qualify as very large kinds or not.

³⁰⁹ The differentia *four-footed* is occasionally used. E.g. 573a9: “the horse, *of all four-footed animals*, most easily delivers its young, produces the least discharge and flow of blood in proportion to its size”; a17, a21, a27, 576a23, 578a6, 8.

BIBLIOGRAPHY

- Balme, D. M. 1972. *Aristotle's De Partibus Animalium I and De Generatione Animalium I*. (revsd. ed. 1992). Clarendon Aristotle Series. Oxford. Another bibliography entry.
- 1987a. "The place of biology in Aristotle's philosophy", in Gotthelf and Lennox 1987, pp. 9-20.
- 1987b. "Aristotle's use of division and differentiae", in Gotthelf and Lennox 1987, pp. 69-89.
- 1987c. "Aristotle's biology was not essentialist", in Gotthelf and Lennox 1987, pp. 291-302.
- 1990. "Matter in the definition: a reply to G.E.R. Lloyd", in Devereux and Pellegrin 1990, pp. 49-54.
- 1991. *Aristotle, History of Animals Books VII-X*. (Prepared for pub. by A. Gotthelf.) Loeb Classical Library. London and Cambridge, MA.
- 2002. *Aristotle, Historia Animalium Volume I, Books I-X: Text*. (Prepared for pub. by A. Gotthelf.) Cambridge Classical Texts and Commentaries. Cambridge.
- (forthcoming). *A Commentary on Aristotle's Historia Animalium, Books I-VII*. Cambridge.
- Barnes, J. 1975. "Aristotle's Theory of Demonstration", in Barnes et al. 1975.
- 1981. "Proof and the Syllogism", in Berti 1981, 17-60.
- ed. 1984. *The Complete Works of Aristotle*, Vols. I-II. Princeton.
- 1993. *Aristotle's Posterior Analytics* (2nd edn.). Clarendon Aristotle Series. Oxford.
- Barnes, J., Schofield, M., Sorabji, R. (eds.) 1975. *Articles on Aristotle: 1. Science*. London.
- Berti, E. (ed.) 1981. *Aristotle on Science: The Posterior Analytics*. Padua.

- Beullens, P. and Gotthelf, A. 2007. "Theodore Gaza's Translation of Aristotle's *De Animalibus*: Content, Influence, and Date", *Greek, Roman, and Byzantine Studies* 47, 4969-513.
- Bolton, R. 1976. "Essentialism and Semantic Theory in Aristotle: *Posterior Analytics* II.7-10", *Philosophical Review* 85, 514-44.
- 1987. "Definition and Scientific Method in Aristotle's *Posterior Analytics* and *Generation of Animals*", In Gotthelf and Lennox 1987, 120-166.
- 1991. "Aristotle's Method in Natural Science: Physics I", in Judson, L. (ed.) 1995. *Aristotle's Physics: A Collection of Essays*. Oxford.
- 2009. "Two Standards for Inquiry in Aristotle's *De Caelo*", in Bowen and Wildberg (eds.), *New Perspectives on Aristotle's De Caelo* (Philosophia Antiqua Vol. 117), Leiden and Boston: Brill, 2009, pp. 51-82
- Bowen, A.C. ed. 1991. *Science and Philosophy in Classical Greece*. New York.
- Burnyeat, M. F. 1981. "Aristotle on Understanding Knowledge", in Berti 1981, 97-140.
- Charles, D. 1990. "Aristotle on Meaning, Natural Kinds and Natural History", in Devereux and Pellegrin 1990.
- 2000. *Aristotle on Meaning and Essence*, Oxford Aristotle Studies. Oxford.
- 2010. "The Paradox in the *Meno* and Aristotle's Attempt to Resolve It", in Charles (ed.) 2010, *Definition in Greek Philosophy*, Oxford.
- Detel W. 1997. "Why all Animals Have a Stomach: Demonstration and Axiomatization in Aristotle's *Parts of Animals*", in Kullmann and Föllinger 1997.
- Devereux, D. and Pellegrin, P. eds. 1990. *Biologie, Logique et Metaphysique chez Aristotle*. Paris.
- Distelzweig, P. 2013. "The Intersectin of Mathematical and Natural Science: The Subordinate Sciences in Aristotle", *Apeiron* 46.2 (2013), pp. 85-105.
- Ferejohn, M. 1991. *The Origins of Aristotelian Science*. New Haven.
- 2009. "Empiricism and the First Principles of Aristotelian Science", in Anagnostopoulos (ed.), *A Companion to Aristotle*, pp. 66-80. Blackwell.
- 2014. *Formal Causes: Definition, Explanation, and Primacy in Socratic and Aristotelian Thought*. Oxford.
- Fortenbaugh, W. W., and Sharples, R. W. eds. 1988. *Theophrastean Studies Volume III*. New Brunswick, NJ.

- Frede, M. 1996. "Aristotle's rationalism", in *Rationality in Greek Thought*, Frede and Striker (eds.), pp. 157–173. Oxford: Clarendon Press.
- Freeland, C. 1990. "Scientific Explanation and Empirical Data in Aristotle's *Meteorology*", *Oxford Studies in Ancient Philosophy* VIII, pp. 67-102.
- Goldin, O. 1996. *Explaining an Eclipse: Aristotle's Posterior Analytics 2.1-10*. The University of Michigan Press. Ann Arbor.
- Gotthelf, A. ed. 1985a. *Aristotle on Nature and Living Things: Philosophical and Historical Studies Presented to David M. Balme on his Seventieth Birthday*. Pittsburgh and Bristol.
- 1985b. "Notes towards a Study of Substance and Essence in Aristotle's *Parts of Animals* ii-iv", in Gotthelf 1985a, pp. 27-54.
- 1987. "First Principles in Aristotle's *Parts of Animals*", in Gotthelf and Lennox 1987, pp. 167-198.
- 1988. "*Historia* I: *plantarum et animalium*", in Fortenbaugh and Sharples 1988, reprinted in Gotthelf 2012a, pp. 293-306.
- 1997a. "Division and Explanation in Aristotle's *Parts of Animals*," in *Festschriften Wolfgang Kullmann*, H.-C. Gunther, Stuttgart: Steiner Verlag, reprinted in Gotthelf 2012a, pp. 197-214.
- 1997b. "The Elephant's Nose: Further Reflections on the Axiomatic Structure of Biological Explanation in Aristotle," *Aristotelische Biologie. Intentionen, Methoden, Ergebnisse*. Herg. W. Kullmann und S. Föllinger, Stuttgart: Steiner Verlag, reprinted in Gotthelf 2012a, pp. 186-196.
- 2012a. *Teleology, First Principles, and Scientific Methodology in Aristotle's Biology*. Oxford.
- 2012b. "Data-Organization, Classification, and Natural Kinds: The Place of the *Historia Animalium* in Aristotle's Biological Enterprise", in Gotthelf 2012a, pp. 261-288.
- 2012c. "*History of Animals* I.6 490b7-491a6: Aristotle's *megista genê*", in Gotthelf 2012a, pp. 293-306.
- Gotthelf, A., Lennox, J.G. (eds.). 1987. *Philosophical issues in Aristotle's Biology*. Cambridge.
- Hankinson, R. J. 2005, "Aristotle on Kind Crossing", in R. Sharples (ed.), *Philosophy and the Sciences in Antiquity*, London, ch. 3.
- Irwin, T. 1989. *Aristotle's First Principles*. Oxford.

- Karbowsky, J. 2014. "Empirical *Eulogos* Argumentation in *GA* III.10", *British Journal for the History of Philosophy* 22,1, pp. 25-38.
- Kosman, L.A. 1973. "Explanation and Understanding in Aristotle's *Posterior Analytics*." in H. D. P. Lee, A. Mourletatos, and R. Rorty (eds.) *Exegesis and Argument*, [= *Phronesis* suppl. vol. 1] (1973) 374-392.
- Lear, J. (1982), "Aristotle's Philosophy of Mathematics", *The Philosophical Review*, Vol. 91, No. 2, pp. 161-192.
- Lennox, J. G. 1985. "Aristotle, Galileo, and the 'Mixed Sciences'", in W. Wallace (ed.), *Reinterpreting Galileo*, Washington D.C., pp. 29-51.
- 1987a. "Divide and Explain: The *Posterior Analytics* in Practice", in Gotthelf and Lennox 1987, reprinted in Lennox 2001b, pp. 7-38.
- 1987b. "Kinds, Forms of Kinds, and the More and the Less in Aristotle's Biology", in Lennox and Gotthelf 1987, pp. 339-59, reprinted in Lennox 2001b, 160-181.
- 1990. "Notes on David Charles on *HA*", in Devereux and Pellegrin 1990, pp. 169-184.
- 1991. "Between Data and Demonstration: The *Analytics* and the *Historia Animalium*", in Bowen 1991, pp. 269-94, reprinted in Lennox 2001b, pp. 39-71.
- 1994. "Aristotelian Problems", *Ancient Philosophy* XIV, pp. 43-57.
- 1996. "Aristotle's Biological Development: The Balme Hypothesis", in Wians 1996, pp. 229-248.
- 1997. "Nature does nothing in vain", in *Beiträge zur antiken Philosophie. Festschrift für Wolfgang Kullmann, Herausgegeben von Hans-Christian Günther und Antonios Rengakos (mit einer Einleitung von Ernst Vogt)*, Stuttgart, pp. 199-214. Reprinted in Lennox 2001b, pp. 205-23.
- 1999. "Aristotle on the Biological Roots of Human Virtue", in Maienschein and Ruse (eds.) *Biology and the Foundations of Ethics*. Cambridge
- 2001a. *Aristotle, On the Parts of Animals I-IV*. Clarendon Aristotle Series. Oxford.
- 2001b. *Aristotle's Philosophy of Biology*. Cambridge.
- 2001c. "Aristotle on the Unity and Disunity of Science, *International Studies in the History and Philosophy of Science*, 15/2, pp. 133-144
- 2004. "Getting a Science Going: Aristotle on Entry Level Kinds" in G. Wolters (ed.), *Homo Sapiens und Homo Faber (Festschrift Mittelstrass)*, Berlin: Walter De Gruyter, 2004, pp. 87-100.

- 2010a. "Bios and Explanatory Unity in Aristotle's Biology", in Charles 2010, pp. 329-55. --
- 2010b. "ΒΙΟΣ, ΠΙΡΑΞΙΣ AND THE UNITY OF LIFE" in S. Föllinger (ed.), *Was ist "Leben": Aristoteles' Anschauungen zur Entstehung und Funktionsweise von Leben*. Franz Steiner Verlag Stuttgart: 2010.
- 2010c. "The Unity and Purpose of *On Parts of Animals I*", in Lennox and Bolton 2010, pp. 56-77.
- 2011. "Aristotle on Norms of Inquiry", *HOPOS: The Journal of the International Society for the History of Philosophy of Science*. Vol. 1, No.1, pp. 23-46.
- 2013. "Preparing for Demonstration: Aristotle on Problems", *Metascience*.
- Lennox, J.G., Bolton, R. eds. 2010. *Being, Nature, and Life in Aristotle: Essays in Honor of Allan Gotthelf*. Cambridge.
- Leunissen, M.E.M.P.J. 2013. "Becoming Good Starts with Nature: Aristotle on the Moral Advantages and the Heritability of Good Natural Character", *Oxford Studies in Ancient Philosophy*, vol. 44, pp. 99-127.
- Lewes, G. H. 1864. *Aristotle: A Chapter from the History of Science*. London.
- Lloyd, G. E. R. 1991. *Methods and Problems in Greek Science*. Cambridge.
- 1996. *Aristotelian Explorations*. Cambridge.
- Louis, P. 1961. *Aristote: De La Génération des Animaux*. Belles Lettres: Paris.
- 1964. *Aristote: Histoire des Animaux: tome I*. Les Belles Lettres: Paris.
- 1968. *Aristote: Histoire des Animaux: tome II*. Les Belles Lettres: Paris.
- 1975. *La découverte de la vie*. Hermann: Paris.
- Machamer, P. 2001. "Memory, Experience, and Action in Aristotle", from the proceedings of *Aristotle Today*, Naoussa, Greece.
- Mayhew, R. Mirhady, D.C. 2011. *Aristotle Vol. XVI: Problems, books 20-38; Rhetoric to Alexander*. Loeb Classical Library, Cambridge.
- McKirihan, R. 1978. "Aristotle's Subordinate Sciences", *BJHS* 11, pp. 197-220.
- 1992. *Principles and Proof*. Princeton.
- Ogle, W. 1882. *Aristotle on the Parts of Animals*. London.
- 1897. *Aristotle on Youth & Old Age, Life & Death, and Respiration*. London.

- Owen, G. E. L. 1975. "*Tithenai ta Phainomena*", in Barnes et al. 1975.
- Peck, A. L. 1965. *Aristotle, Historia Animalium*. Vol. I: Books I-III. Loeb classical Library. London and Cambridge, MA.
- 1970. *Aristotle, Historia Animalium*. Vol. II: Books IV-VI. Loeb Classical Library. London and Cambridge, MA.
- Pellegrin, P. 1986. *Aristotle's Classification of Animals*, tr. A. Preus. Berkeley.
- Ross, W. D. 1923. *Aristotle*. London
- 1949. *Aristotle's Prior and Posterior Analytics*. Oxford.
- Sachs, J. 1999. *Aristotle's Metaphysics*. Green Lion Press. Santa Fe, NM.
- 2001. *Aristotle's On the Soul and On Memory and Recollection*. Green Lion Press. Santa Fe, NM.
- 2006. *Aristotle's Poetics*. Focus. Newburyport, MA.
- 2009. *Plato Gorgias and Aristotle Rhetoric*. Focus. Newburyport, MA.
- 2012. *Aristotle: Politics*. Focus. Newburyport, MA.
- Smith, R. 1989. *Aristotle Prior Analytics*. Hackett: Indianapolis.
- Strassler, R.B. (ed.). 1996. *The Landmark Thucydides*. New York.
- 2007. *The Landmark Herodotus*. New York.
- Stoyles, B.J. 2012. "*Megista Genê* and Division in Aristotle's *Generation of Animals*", *Apeiron*, 46(1), pp. 1-25.
- Thomson, M.M. (ed.). 1979. *Greek Numismatics and Archaeology*.
- Wians, W. (ed.). 1996. *Aristotle's Philosophical Development*. Lanham, MD.
- Wilson, M. 2000. *Aristotle's Theory of the Unity of Science*. Toronto.